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Yucca Mountain Project

***Site Environmental Report for the
Yucca Mountain Project
Calendar Year 2002***

PGM-MGR-EC-000004

REV 00

October 2003

*U.S. Department of Energy
Office of Civilian Radioactive Waste Management
Office of Repository Development
Las Vegas, Nevada*

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PREFACE

As an operating unit of the U.S. Department of Energy, it is the policy and practice of the Office of Repository Development to conduct its operations in a safe and environmentally sound manner. DOE Policy 450.4. requires the Department to systematically integrate safety into management and work practices at all levels so that missions are accomplished while protecting the public, the worker, and the environment. The Department has made it clear that protection of the public, the worker, and the environment is of paramount importance.

In accordance with DOE Order 5400.1 and DOE Order 231.1 the status of the Yucca Mountain Project's 2002 environmental program is summarized in this annual site environmental report.

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10-7-03

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EXECUTIVE SUMMARY

This site environmental report describes the environmental program conducted during 2002 for the U.S. Department of Energy, Office of Repository Development. The report describes the environmental laws and regulations that were applicable to the Yucca Mountain Project in 2002, the actions taken to comply with those laws and regulations, and the Project's environmental program. The report also summarizes the data collected to monitor potential impacts of the Project on the environment.

Mission and 2002 Accomplishments—On February 14, 2002, the Secretary of Energy submitted a comprehensive statement to the President of the United States, recommending Yucca Mountain, Nevada, as the site for a geologic repository. This recommendation was made after more than two decades of scientific investigations by the U.S. Department of Energy to determine the suitability of Yucca Mountain to isolate spent nuclear fuel and high-level radioactive waste. The President approved the Secretary's recommendation on February 15, 2002, and forwarded it to the U.S. Congress. On April 8, 2002, the Governor of Nevada vetoed the President's recommendation. On May 8 and July 9, 2002, the House of Representatives and the Senate, respectively, passed resolutions overriding the governor's veto. On July 23, 2002, the President signed into law the Congressional Joint Resolution designating Yucca Mountain, Nevada, as the site for the nation's first geologic repository per section 115(c) of the Nuclear Waste Policy Act, as amended.

The Secretary's recommendation of the Yucca Mountain site on February 14, 2002, marked the end of the site characterization phase of the Yucca Mountain Project. As required by Section 113 of the Nuclear Waste Policy Act, the tests and studies conducted during site characterization were designed to determine the suitability of the Yucca Mountain site for a repository. During the remainder of 2002, the Department's emphasis shifted to the preparation of a license application that will be submitted to the U.S. Nuclear Regulatory Commission to construct and ultimately operate the repository. The license application is expected to be submitted in December 2004. Upon submittal, the Commission will have three years to review the application, conduct its licensing proceedings, and reach a construction authorization decision. Should the Commission grant the construction authorization, the Department will update the license application and request a license to receive and possess high-level radioactive waste as initial construction of the repository nears completion. If the Commission grants the license to receive and possess, the Department will begin placing the waste into the repository. In the final phase of licensing, when the repository has stopped receiving waste for disposal, the Department will apply for a license amendment to decommission and permanently close the repository.

Although site characterization ended on February 14, 2002, the Office of Repository Development continued to conduct testing through the remainder of 2002. These activities were designed to further refine the understanding of how a repository at Yucca Mountain would perform far into the future. Some of these efforts may continue indefinitely or until the repository is permanently closed. Information gathered from these tests will be evaluated for its effect on repository performance as part of an ongoing learning process. Design and operating decisions will be modified based on the results of the studies and tests, as well as other

technological and policy developments. This ongoing learning process is designed to challenge existing models and assumptions and lead to continuous improvement.

Environmental Compliance—During 2002, the Yucca Mountain Project had no violations of environmental permits or noncompliance actions; no reportable occurrences that required notification of a regulatory agency; and no notices of violations, deficiencies, announcements of intent to sue for noncompliance with environmental regulations, or other types of enforcement actions. The following actions were taken during 2002 to maintain environmental permits and comply with environmental regulations:

- The Project implemented a procedure to examine activities conducted after the site recommendation for compliance with the National Environmental Policy Act of 1969 (43 USC 4321).
- Several actions were taken to further implement the Environmental Management System required by Executive Order 13148 and DOE Notice 450.4, including an assessment of current environmental management practices on the Project.
- An administrative land withdrawal to preclude the filing of mining claims at Yucca Mountain, which was to expire on September 25, 2002, was extended to January 31, 2010.
- In November 2002, work started on a new Stormwater Pollution Prevention Plan to address the weekly inspection requirements of a new stormwater general permit issued on September 16, 2002.
- A request to extend the temporary water-appropriation permits was denied by the Nevada State Engineer. Therefore, on April 9, 2002, the temporary water-appropriation permits for Wells J-12, J-13, C-1, C-2, and C-3 expired. Legal appeals continued on a ruling by the Nevada State Engineer against the Department's application for a permanent withdrawal of 430 acre feet per year of groundwater for a repository at Yucca Mountain.
- The annual permit to operate the public water supply system at Yucca Mountain was renewed.
- The Project's underground injection-control permit expired in January 2002. A permit-renewal application was submitted in 2000, and the State of Nevada deemed the application to be complete. This action allowed the Project to continue working under the existing permit until a new permit is issued.
- Numerous reports on the following subjects were prepared and submitted to federal and state regulatory agencies and other organizations in compliance with regulatory requirements:
 - Hazardous materials and chemicals
 - Wastes generated and recycled, including efforts to minimize waste generation

- Purchase and use of recycled materials
- Use of sand and gravel
- Desert tortoises
- Air emissions
- Underground injections
- Archaeological surveys and monitoring.

Environmental Programs—The following actions were taken as part of the environmental program conducted in 2002 to implement permit requirements, monitor impacts, and protect the environment:

- Nine requests for land access were reviewed by the Office of Repository Development. Approval was granted for all requests, which included six scientific studies, two construction projects, and one plan for reclaiming disturbed sites.
- Approximately 0.4 acres of land was cleared of vegetation or soil in 2002, bringing the total amount of land disturbed by the Project since 1991 to 319 acres. This is 95 acres less than the total of 414 acres stipulated in the biological opinion for the Yucca Mountain Project.
- No desert tortoises were found during pre-activity surveys, and no tortoises were harmed on roads or at other sites during 2002.
- Final reclamation was completed at 26 sites totaling 7.4 acres, and 129 previously reclaimed sites were monitored.
- Six archaeological pre-activity surveys and three pre-reclamation surveys were conducted in 2002. No new archaeological sites or isolated artifacts were identified during these surveys.
- A general overview of the archaeology of Yucca Mountain was released in 2002. The book describes, among other things, some of the most important findings of the Project's archaeology program.
- The Project continued consultations and interactions with involved Native American tribes and organizations.
- Air quality was monitored at 3 sites, and meteorological measurements were taken at 12 sites at Yucca Mountain. Concentrations of airborne particulate matter continued to be far below allowable maximum concentrations. Precipitation during 2002 was only about 20 percent of the recent 7-year average.
- Groundwater levels were measured at 40 sites to monitor fluctuations in groundwater levels and evaluate potential regional effects from groundwater withdrawals at Yucca Mountain. Data show that, between 1992 and 2000, water levels in Jackass Flats, where the Project withdraws the majority of its water, either had slight upward trends or have

not changed. The withdrawal of groundwater for Project activities has had no measurable effect on regional groundwater levels or spring flows.

- From 2001 to 2002, there was a reduction of 484 pounds in the amount of hazardous waste generated by the Project. The total quantity of hazardous waste collected for 2002 was 201 pounds. Universal waste (mostly fluorescent lamps and nickel-cadmium batteries) totaling 638 pounds was also collected. As part of the Project's pollution prevention program, about 300 tons of material and 54,000 gallons of liquid were recycled, and 331 computers and 3,478 notebook binders were reused.
- Also as part of the Project's pollution prevention program, two assessments of ways to increase recycling on the Project were completed in 2002. In addition, efforts were launched to increase awareness among employees on the importance of pollution prevention.
- The purchase of items manufactured with recycled content increased to 90 percent in fiscal year 2002, compared to about 75 percent in fiscal year 2001.
- A compressed-natural-gas refueling station was put into service in 2002 near Project facilities in Las Vegas to service alternative-fuel vehicles.
- Nine assessments were conducted to evaluate compliance with environmental, safety, and health requirements.
- Three hundred fifty-two environmental surveillances were conducted to monitor compliance and track environmental performance. Positive observations, noteworthy practices, or no environmental concerns were identified in 337 of the surveillances. Of the 15 surveillances for which concerns were noted, 7 corrective actions were for spills and waste management issues and 8 were for noncompliance with procedures and plans. There were no permit violations or reportable spills in 2002. Trends in environmental performance indicate continued improvement during 2002.
- All new employees attended a training course on the Project's environmental, safety, and health requirements; all employees participated in an annual refresher course on these requirements. All new employees who work unescorted at Yucca Mountain attended site access training. Managers and supervisors attended a course on environmental regulatory compliance.
- When required, Project personnel were trained in hazardous waste management and transportation and in the requirements for detecting and responding to releases of hazardous materials.

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ACRONYMS

BLM	Bureau of Land Management
BSC	Bechtel SAIC Company, LLC
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
EIS	environmental impact statement
EMS	Environmental Management System
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ES&H	Environment, Safety, and Health
FR	Federal Register
ISMS	Integrated Safety Management System
NAC	Nevada Administrative Code
NEPA	National Environmental Policy Act
NRC	U.S. Nuclear Regulatory Commission
NRS	Nevada Revised Statutes
NWPA	Nuclear Waste Policy Act, as amended
ORD	Office of Repository Development
PM ₁₀	particulate matter 10 micrometers or less in diameter
QA	quality assurance
RCRA	Resource Conservation and Recovery Act of 1976
ROWR	Right-of-Way Reservation
SHPO	State Historic Preservation Officer
YMP	Yucca Mountain Project

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1. INTRODUCTION

This is the twelfth annual site environmental report prepared by the U.S. Department of Energy (DOE), Office of Repository Development (ORD). The purpose of this report is to describe the ORD environmental program, compliance with environmental standards and requirements, and performance of environmental activities during calendar year 2002.

This report was prepared in accordance with DOE Order 5400.1, DOE Order 231.1 and guidance from the DOE Office of Environmental Policy and Assistance (Lawrence 2003). These guidelines emphasize reporting emissions of, and human exposure to, radionuclides and other pollutants and hazardous substances. The Yucca Mountain Project (YMP) has not caused any public exposure to non-naturally occurring radionuclides, nor is the YMP a major source of pollutants or hazardous substances. Therefore, this report does not emphasize those topics and differs from the content suggested in the guidance in the following ways:

- This report does not contain a section describing the results of environmental radiological monitoring, radiological doses, or releases from operation of DOE facilities. The YMP currently does not manage radioactive materials beyond a few sealed industrial sources, and there are no effluents that require monitoring. Thus, monitoring the environment or calculating potential doses to offsite or onsite populations is not applicable.
- Sections identified in the guidance as "Environmental Program Information" and "Environmental Non-Radiological Program Information" has been combined as Section 3 of this report (Environmental Programs). This was done because the monitoring and surveillance data (which the guidance suggests be included in the latter section) are brief and best understood in the context of the environmental program.
- The YMP groundwater monitoring program is included in Section 3 (instead of in a separate section as suggested by the guidance) because the Project does not release effluents into the groundwater. A description of the hydrology of Yucca Mountain and the surrounding region is included in Section 1.1.3.

Yucca Mountain, which is the site for the repository, is located in a remote desert location in Nye County, Nevada. The YMP, however, occupies and operates facilities both in Nye and Clark Counties, Nevada, and one office building in Washington, DC. In Clark County, the ORD and its management and operating contractor, Bechtel SAIC Company, LLC (BSC), occupy 15 office buildings in a suburban business park in Las Vegas, Nevada. BSC also uses two warehouses in Las Vegas for receiving, storing, and distributing materials and equipment. A project science center also is operated in Las Vegas to disseminate information on the YMP. Laboratory-testing activities are conducted in two buildings at the DOE's Nevada Nuclear Security Agency operation complex in North Las Vegas. Activities conducted in the Las Vegas office facilities consist primarily of Project administration and technical support, management, scientific analyses and modeling, and engineering design. Similar activities are conducted by BSC in office facilities in Washington, DC. In Nye County, the YMP operates a science center in the city of Pahrump and another in Beatty. All YMP facilities except those at Yucca Mountain are serviced by municipal utilities such as sewer, water, electrical,

telecommunications, and waste disposal. Utility services at Yucca Mountain are part of the operation and maintenance of that site and, therefore, the responsibility of the YMP.

Development of this report was not subject to the requirements of the YMP *Quality Assurance Requirements and Description* (DOE 2002a), as determined by the DOE.

1.1 SITE DESCRIPTION

The Yucca Mountain site ("the site") encompasses about 30,000 acres on lands administered by the federal government in a remote part of the northern Mojave Desert. The site is in Nye County, south-central Nevada, about 100 miles northwest of Las Vegas, Nevada (Figure 1).

Yucca Mountain is an irregularly shaped, north-trending, volcanic upland, 4-6 miles wide and 25 miles long. The crest of that portion of the mountain being investigated by the DOE has an elevation of 4,600-4,950 feet. The main ridge in this area slopes steeply to the west into Crater Flat (elevation 3,900 feet) and gently eastward to Jackass Flats on the Nevada Test Site (elevation 3,600 feet).

The following sections briefly describe the physical, biological, cultural, and demographic settings of the Yucca Mountain area. More detailed information about the site can be found in the *Yucca Mountain Site Description* (CRWMS M&O 2000) and the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE 2002b).

1.1.1 Climate and Meteorology

Typical of southwestern deserts, the climate at Yucca Mountain is warm and arid to semi-arid (CRWMS M&O 1999a; 2000, Section 2.3). Average maximum and minimum daily temperatures in Midway Valley near the Yucca Mountain site range from 22°C to 34°C (72°F to 93°F) in the summer and from 2°C to 10.5°C (34°F to 51°F) in the winter. Average annual precipitation at the network of Yucca Mountain meteorological stations ranges from 4 to 10 inches, depending on elevation and topography. Annual precipitation varies greatly among years because of differences in regional storm patterns. Occasional periods of persistent or heavy rains, particularly in the winter, have produced more than 2 inches of rain in a day. Summer thunderstorms can drop more than 1 inch in a matter of hours, sometimes resulting in flash floods along the usually dry washes that drain Yucca Mountain. Potential evaporation is almost 66 inches per year.

Winds in the region are influenced by nearby mountains and valleys and large-scale weather systems. Winds near Yucca Mountain generally blow to the south or southeast during the day and to the north or northwest at night. Average hourly wind speeds range from 5.8 to 9.6 miles per hour, and calm periods are rare and short-lived. The strongest winds typically occur on exposed ridges. Maximum wind gusts have reached over 85 miles per hour.

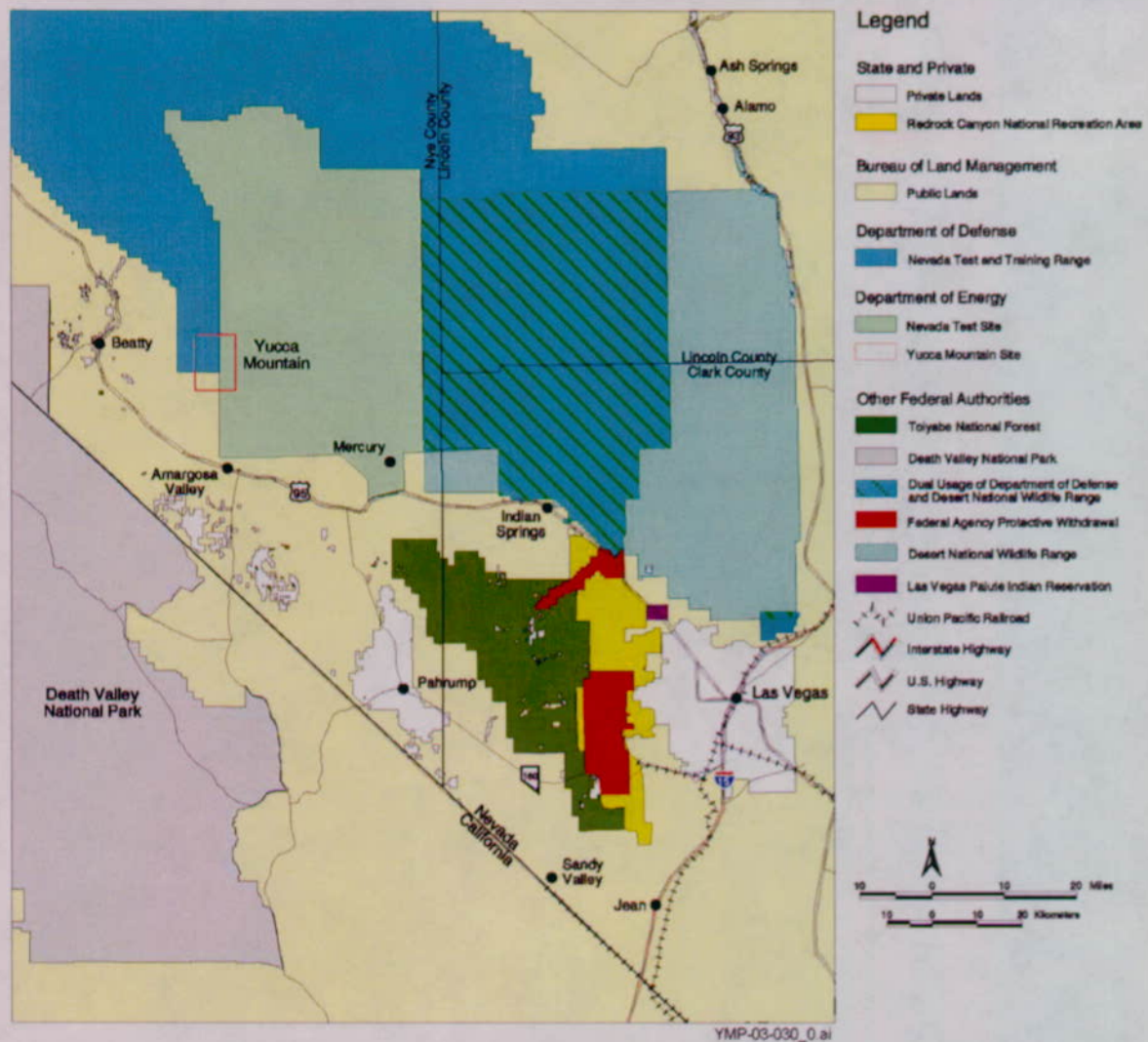


Figure 1. Land Use and Ownership Surrounding Yucca Mountain

1.1.2 Geology

The mountains and valleys visible today in the region of Yucca Mountain formed over the past 15 million years from movement along faults. Rocks and sedimentary deposits in this region range in age from geologically old in some mountains (Precambrian era, or more than 570 million years old) to geologically recent in the valleys (Holocene epoch, or less than 10,000 years old). At Yucca Mountain, most rocks exposed at the surface originated from volcanic eruptions between 11.5 million and 14 million years ago.

The oldest and deepest rocks at Yucca Mountain are more than 570 million years old. They occur more than 4.7 miles below the surface. Overlying these rocks are Paleozoic sedimentary

rocks between 225 and 570 million years old. The lower part of these Paleozoic rocks, which are 3 miles thick and more than 1.1 miles below the surface, are part of a regional carbonate aquifer.

The Paleozoic rocks beneath Yucca Mountain are overlain by 1.6 miles of volcanic ash-flow tuffs and ashfalls that are widely exposed at the surface. These rocks originated between 11.5 million and 14 million years ago (during the Tertiary Period) from circular volcanic centers known as calderas. The eroded remnants of these calderas, some measuring many miles across, are still visible north of Yucca Mountain.

Overlying the Tertiary volcanic rocks at and surrounding Yucca Mountain are unconsolidated rocks known as alluvium and several small cinder cones and basaltic lava flows. These rocks are all younger than 1.6 million years old (Quaternary Period). The alluvial deposits developed from erosion of nearby highlands. The alluvium was then transported by water, wind, and gravity to lower elevations. Fans of alluvium form large aprons along the flanks of Yucca Mountain. Most of the alluvial deposits that are visible at the surface in the Yucca Mountain area probably formed within the last 100,000 years. In Crater Flat, west of Yucca Mountain, several small cinder cones and lava flows erupted between 1 million and 3.7 million years ago. The youngest volcanic center in the area is the Lathrop Wells cone, estimated to have erupted about 80,000 years ago. The cone is 9.3 miles southwest of Yucca Mountain.

Five earthquakes with Richter magnitudes greater than 5.5 have been recorded within 60 miles of Yucca Mountain. Except for the Little Skull Mountain earthquake, all occurred near the Death Valley–Furnace Creek fault system more than 30 miles south of Yucca Mountain. The 1992 Little Skull Mountain earthquake occurred 9 miles from Yucca Mountain and had a magnitude of 5.6 (CRWMS M&O 2000, Section 12.3).

1.1.3 Hydrology

Yucca Mountain is within the Alkali Flat–Furnace Creek Groundwater Basin of the Central Death Valley Subregion (Figure 2). This groundwater system is closed, that is, water leaves the system only by evapotranspiration. The primary source of recharge in this area is infiltration of precipitation on Pahute Mesa, Timber Mountain, and Shoshone Mountain in the central part of the subregion, and the Grapevine and Funeral Mountains in the southwestern part of the subregion (D’Agnese et al. 1997) (Figure 2).

Groundwater in the saturated zone beneath Yucca Mountain occurs at a depth of 1,600–2,500 feet below the surface in volcanic aquifers and in a much deeper carbonate aquifer. This groundwater discharges naturally more than 50 miles south of Yucca Mountain at Alkali Flat (Franklin Lake Playa) and in Death Valley (Figure 2) (D’Agnese et al. 1997). Water used by the YMP is pumped from the volcanic aquifers in Crater Flat and Jackass Flats.

There are no springs, wetlands, or other natural sources of surface water at Yucca Mountain (Hansen et al. 1997). The usually dry washes in the area may contain flowing water after very heavy, sustained rain or snow. On rare occasions, water in the washes flows to the Amargosa River more than 25 miles to the south. Although referred to as a “river,” the Amargosa is dry along most of its length. Exceptions include short stretches of the river near Beatty, Nevada;

Tecopa, California; and southern Death Valley, California, where the river ends in the Badwater Basin, 260 feet below sea level (DOE 2002b, Section 3.1.4.1.1).

1.1.4 Biological Resources

Plants typical of the Mojave Desert are most abundant at elevations below 4,000 feet. Common shrubs include white bursage (*Ambrosia dumosa*), creosotebush (*Larrea tridentata*), Nevada jointfir (*Ephedra nevadensis*), littleleaf ratany (*Krameria erecta*), pale wolfberry (*Lycium pallidum*), California buckwheat (*Eriogonum fasciculatum*), and spiny hopsage (*Grayia spinosa*) (CRWMS M&O 1998a).

Species typical of the Great Basin Desert and the transition zone between the Great Basin Desert and Mojave Desert are most abundant at elevations above 4,000 feet, primarily in the northern part of the Project area. Blackbrush (*Coleogyne ramosissima*) is the most abundant shrub at mid-to high-elevations growing on gentle slopes. Steep slopes at high elevations are dominated by California buckwheat, heathgoldenrod (*Ericameria teretifolius*), Nevada jointfir, broom snakeweed (*Gutierrezia sarothrae*), and green ephedra (*Ephedra viridis*). Big sagebrush (*Artemisia tridentata*) is common on some steep north-facing slopes (CRWMS M&O 1998a).

Thirty-six species of mammals have been recorded at Yucca Mountain, none of which are classified as threatened or endangered. Rodents are the most abundant mammals, with 17 documented species (CRWMS M&O 1997). Seven species of bats have been recorded at Yucca Mountain (CRWMS M&O 1998b); two of these, the long-legged myotis (*Myotis volans*) and fringed myotis (*Myotis thysanodes*), are considered sensitive species in Nevada by the Bureau of Land Management (BLM). Three species of rabbits, seven carnivores, and two ungulates (mule deer [*Odocoileus hemionus*] and feral burros [*Equus asinus*]) also have been seen at Yucca Mountain (CRWMS M&O 1999b).

Twenty-seven species of reptiles have been found at Yucca Mountain, including 12 species of lizards, 14 species of snakes, and one species of tortoise (CRWMS M&O 1998c). The desert tortoise (*Gopherus agassizii*) is listed as threatened under the Endangered Species Act (Section 2.3.1), and the western chuckwalla (*Sauromalus obesus*) is classified as a sensitive species in Nevada by the BLM.

More than 120 species of birds have been seen in the Yucca Mountain region, including 15 species of raptors (CRWMS M&O 1998d). Western burrowing owls (*Speotyto cunicularia hypugaea*), which are uncommon at the site, are classified as sensitive in Nevada by the BLM.

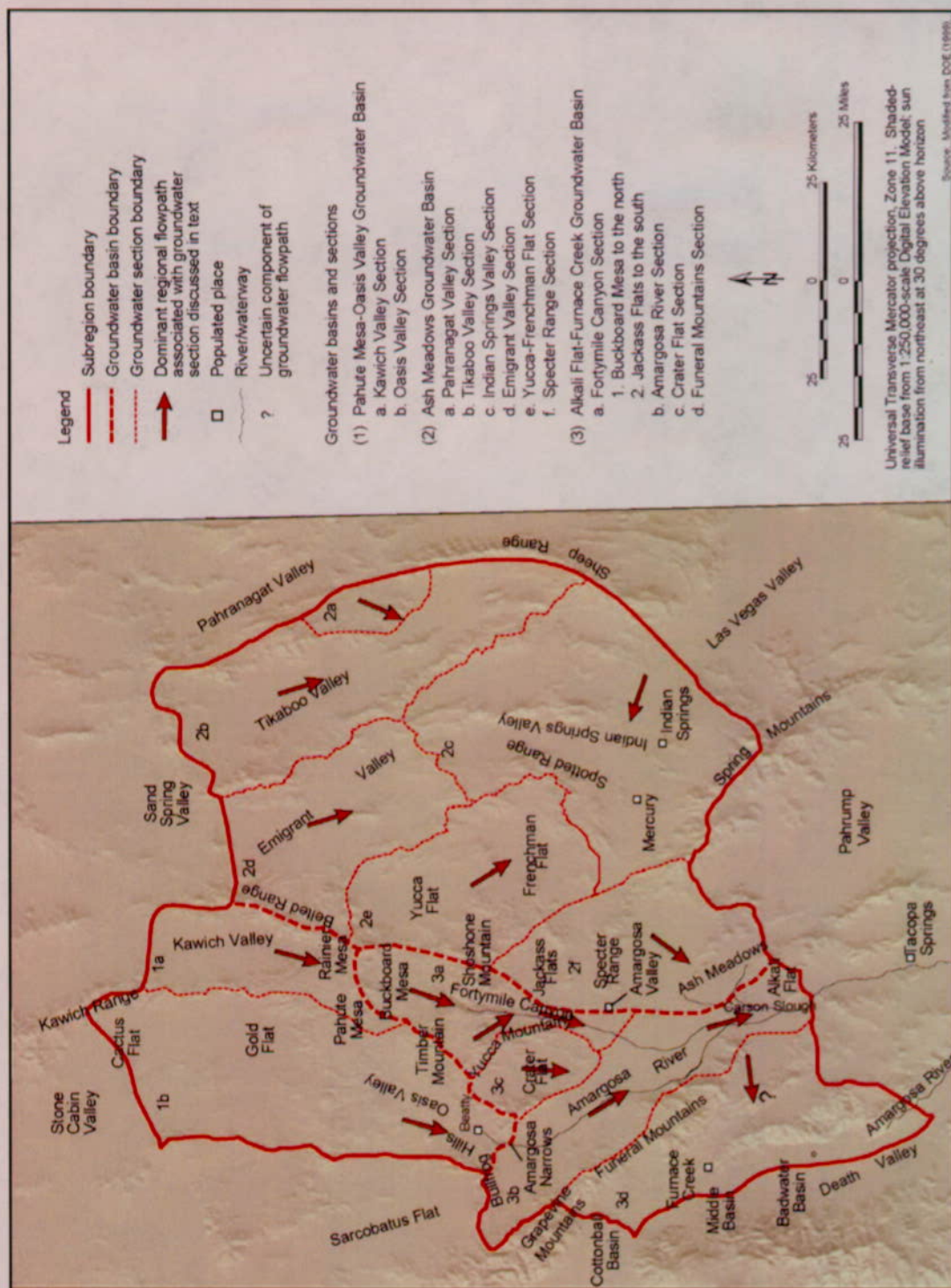


Figure 2. Groundwater Basins in the Vicinity of Yucca Mountain

1.1.5 Cultural Resources

Archaeological resources found at and near Yucca Mountain indicate past use by small, mobile groups of aboriginal hunter-gatherers, after which Euroamericans used the area for limited prospecting and, possibly, ranching (DOE 1990, Section 2.4.3). The region may have been inhabited by humans as long as 12,000 years ago. At that time, most activity seems to have centered along major drainages. By 7,000 years ago, a second settlement pattern is discernible, with the establishment of temporary camps in the uplands of Yucca Mountain, some distance from water sources. A third shift in the pattern of settlement occurred about 1,500 years ago, indicated by the presence of sites, often with grinding stones, on alluvial fans or in small rock shelters in uplands. By that time, sites were no longer being established along major drainages, perhaps indicating that these waterways were dry. Instead, sites were located near small, seasonal water sources such as depressions in solid rock. A fourth and most recent period of settlement is associated with Euroamericans, indicated by rock cairns (piles of rock), tin cans, and temporary camps (DOE 1990, Section 2.4.3). At the time of the first recorded arrival of Euroamericans in 1849, the area was inhabited by Southern Paiute and Western Shoshone Indians (Stoffle et al. 1990).

Many archaeological surveys have been conducted at Yucca Mountain. As a result, more than 900 historical properties, ranging from single fragments of ceramic or pottery vessels (sherds) to campsites and quarries, have been identified.

1.1.6 Demography

Nye County and surrounding areas are rural, sparsely populated, and have most residents concentrated in a few small communities. County populations, as determined by the U.S. Census Bureau during the decennial census of April 2000, were as follows: Nye County, Nevada, 32,485 residents; Lincoln County, Nevada, 4,165 residents; Esmeralda County, Nevada, 971 residents; and Inyo County, California, 17,945 residents (U.S. Census Bureau 2001a, 2001b). Estimates of the population within each of these counties during July 2002 were 34,499; 4,243, 884; and 18,214 residents, respectively (U.S. Census Bureau 2003a, 2003b).

To evaluate potential impacts of a repository on the public, the number of people living within a circular area 52 miles in radius surrounding Yucca Mountain is tracked for each of 161 sectors within the circular area. During 2002, 30 of the sectors contained residents. The population in this area was estimated to be 22,816 during 2002 (11.1 people/mile²) in the sectors with residents), with the majority of the population living in or near a few communities (BSC 2002a, Table 1). Within Nye County, the community of Pahrump is split by the southeastern perimeter of the study circle. The estimated population of the portion of Pahrump that lies within the study circle is 18,142. The Amargosa area, including the community of Amargosa Valley, 15 - 20 miles south of Yucca Mountain, has an estimated population of 1,397. The area including Beatty, 20 miles west of Yucca Mountain, has an estimated 1,234 residents. In Clark County, the Indian Springs area 47 miles east of Yucca Mountain has an estimated population of 1,512. In Inyo County, California, the estimated population within the study area is 531 in and near Death Valley National Park (BSC 2002a, Table 1). Las Vegas is 100 miles southeast of Yucca Mountain, outside of the radiological-monitoring study area.

1.1.7 Land Use

Land within the Yucca Mountain site is controlled by three federal agencies: the DOE, U.S. Air Force, and the BLM (Figure 1). Public access to DOE and U.S. Air Force lands is restricted. Some off-highway driving and other recreational activities occur on the BLM portion of the site.

Because of a lack of surface water and very deep groundwater, there is little agriculture in the region surrounding Yucca Mountain. The nearest farms are in the Amargosa Valley, 15 miles to the south. The Pahrump Valley, 47 miles to the southeast, also has some farming operations. There are a limited number of BLM-issued grazing leases for southern Nye County, and none have been issued for lands at or surrounding the site. Several mining operations exist near Yucca Mountain; the closest is a cinder mine 9.3 miles southwest of Yucca Mountain.

Areas south and southwest of the repository site are popular throughout the year for recreational activities such as camping, hiking, hunting, and nature study. Two that are particularly well known are Ash Meadows National Wildlife Refuge (about 25 miles south) and Death Valley National Park (about 20 miles southwest).

1.2 MISSION AND CURRENT ACTIVITIES

1.2.1 Site Recommendation and Approval

On February 14, 2002, the Secretary of Energy submitted a comprehensive statement to the President recommending Yucca Mountain as the site for a geologic repository. This recommendation was made after more than two decades of scientific investigations by DOE to determine the suitability of Yucca Mountain to isolate spent nuclear fuel and high-level radioactive waste. The President approved the Secretary's recommendation on February 15, 2002, and forwarded it to Congress. On April 8, 2002, the Governor of Nevada vetoed the President's recommendation. On May 8 and July 9, 2002, the House of Representatives and the Senate, respectively, passed resolutions overriding the governor's veto. On July 23, 2002, the President signed into law the Congressional Joint Resolution designating Yucca Mountain as the site for the nation's first geologic repository per section 115(c) of the Nuclear Waste Policy Act, as amended (NWSA).

The Secretary's recommendation of the Yucca Mountain site marked the end of the site characterization phase of the project. As described in Section 113 of the NWSA, the tests and studies conducted during site characterization were designed to determine the suitability of the Yucca Mountain site for a repository. During the remainder of 2002, emphasis shifted to the preparation of a license application that will be submitted to the U.S. Nuclear Regulatory Commission (NRC) to construct and ultimately operate the repository (Section 1.2.2), and continuing studies at the site (Section 1.2.3).

1.2.2 Licensing Efforts

After the site recommendation on February 14, 2002, the Department's emphasis shifted to the preparation of a license application that will be submitted to the NRC to construct and ultimately operate the repository. The license application is expected to be submitted in December 2004.

Upon submittal, the NRC will have three years to review the application, conduct its licensing proceedings, and reach a construction authorization decision. Should the NRC grant the construction authorization, the Department will update the license application and request a license to receive and possess high-level radioactive waste as initial construction of the repository nears completion. If the Commission grants the license to receive and possess, the Department will begin placing the waste into the repository. In the final phase of licensing, when the repository has stopped receiving waste for disposal, the Department will apply for a license amendment to decommission and permanently close the repository.

During 2002, DOE interactions with the NRC continued to focus on addressing and resolving topics that the NRC considers important to evaluating the performance of a repository at Yucca Mountain. DOE also continued to address issues of quality assurance (QA). Necessary changes were made at all levels of the program to ensure that important QA issues were expeditiously resolved and that actions were taken to prevent recurrence of QA problems. During 2002, the DOE continued to create and maintain a nuclear safety culture and to rigorously comply with QA procedures, two key elements necessary for successful licensing and safe operation of the repository.

1.2.3 Continuing Studies

Per the NWPA, the site characterization phase of the Project ended on February 14, 2002, with the Secretary's recommendation of the site to the President (see DOE 2002c for a discussion of the final biannual report on site characterization). During the remainder of 2002, the ORD continued testing at Yucca Mountain to further refine the understanding of how a repository would perform far into the future. Some of these studies may continue indefinitely or until the repository is permanently closed.

Some of the geologic and hydrologic studies and tests that started before site characterization ended in early 2002 continued through the calendar year. For example, the Drift Scale Test in Alcove 5 completed a 4-year heating phase on January 14, 2002, after which the power supply to heaters was switched off. It is expected to take about 1 year for drift-wall temperatures to fall from 205°C to below boiling. Data acquisition continued through 2002 during this cooling phase to gain an understanding of the effects of cooling on the surrounding rocks.

Information gathered from these tests will be evaluated for its effect on repository performance as part of an ongoing learning process. Design and operating decisions could be modified based on the results of these studies and tests, as well as other technological and policy developments. The ongoing learning process is designed to challenge existing models and assumptions and lead to continuous improvement.

1.2.4 Major Documents Issued in 2002

In early 2002, the DOE issued several major documents supporting the February 14, 2002, site recommendation. These documents are described briefly in this section.

In February 2002, DOE issued Revision 1 of the *Yucca Mountain Science and Engineering Report* (DOE 2002d). This report summarized the scientific and technical information

developed during more than 20 years of studies of Yucca Mountain and formed the technical basis for the site recommendation. The report described, among other things, the design of the repository; the proposed waste forms and packaging; the relationship between the waste forms and packaging and the geologic medium of the site; and the data obtained during site characterization activities, relating to the safety of the site.

The technical information in the *Yucca Mountain Science and Engineering Report* was evaluated in the *Yucca Mountain Site Suitability Evaluation* issued in February 2002 (DOE 2002e). This evaluation assessed the expected performance of the Yucca Mountain site against the final radiation-protection standards of the U.S. Environmental Protection Agency (EPA) [40 Code of Federal Regulations (CFR) Part 197] and the final licensing regulations of the NRC (10 CFR Part 63). The evaluation for the preclosure and postclosure periods concluded that the Yucca Mountain site is likely to meet applicable radiation-protection standards.

In February 2002, DOE issued a *Site Recommendation Comment Summary Document* (DOE 2002f). This document contained the following:

- Views and comments from governors and state legislatures and the Secretary's responses to those views and comments, as required by the NWPA
- Comments from elected federal, state, and local officials and representatives of Native American tribes and the DOE's responses to those comments
- Summary comments for all comments received from the general public and DOE's summary responses to those comments.

Before the initial comment period ended, the DOE issued several reports that addressed, among other things, the expected performance of a repository at Yucca Mountain against recently promulgated regulations for licensing, issued by the NRC. To provide an opportunity for the public to comment on information that was not available before the conclusion of the initial comment period, including these reports, the Secretary of Energy established a 30-day supplemental comment period from November 14 to December 14, 2001. To ensure that all comments posted to the DOE within the established supplemental comment period were received by the DOE, a decision was made to continue to accept and address comments received through close of business December 21, 2001. Responses to all comments received after October 31, 2001, through the end of the supplemental comment period, are provided in the *Supplemental Site Recommendation Comment Summary Document* (DOE 2002g).

In February 2002, the DOE issued the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE 2002b; referred to hereafter as "final EIS"). The preferred alternative was to proceed with the Proposed Action, which is to construct, operate and monitor, and eventually close a geologic repository at Yucca Mountain, and to use mostly rail, both nationally and in Nevada, to transport spent nuclear fuel and high-level radioactive waste to the repository. Major conclusions of the final EIS were that the Proposed Action would cause small, short-term public health impacts, primarily from nonradiological traffic fatalities during transport

of spent nuclear fuel and high-level radioactive waste from existing commercial and DOE sites to the repository. Long-term impacts to public health from the repository would be very small.

Analyses in the final EIS demonstrated that performance of the repository over 10,000 years would result in a mean peak annual dose of 0.00002 millirem to a reasonably maximally exposed individual located (hypothetically) 11 miles from the repository. The analysis of a human intrusion event occurring at 30,000 years indicated a mean peak annual dose of 0.002 millirem to the reasonably maximally exposed individual at the same location. Consequently, DOE would not expect the repository to result in impacts to public health beyond those that could result from the prescribed radiation exposure and activity concentration limits in 40 CFR Part 197 and 10 CFR Part 63 during the 10,000-year period after closure.

1.2.5 Other Activities

During 2002, the DOE consulted and coordinated with numerous federal, state, and local agencies and Native American tribal organizations in preparation for the site recommendation that was made on February 14, 2002. See Section 3.4.3 for additional information.

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2. ENVIRONMENTAL COMPLIANCE

This section briefly describes the laws and regulations that applied to YMP activities conducted in 2002 (see the *Yucca Mountain Site Characterization Project Requirements Document* [YMP 2001a, Section 7], for more information). This section also summarizes actions taken by the ORD to comply with those laws and regulations, lists the environmental permits applicable to YMP activities in 2002 (Table 1), and summarizes permit-related litigation (Section 2.9). Included is a description of laws and regulations listed in the DOE guidance for development of site environmental reports (Lawrence 2003) that were not applicable to YMP activities in 2002 and an explanation of why they were not applicable.

During 2002, the YMP had no violations of environmental permits or noncompliance actions; no reportable occurrences that required notification of a regulatory agency; and no notices of violations, deficiencies, announcements of intent to sue, or other types of enforcement actions concerning environmental compliance.

2.1 GENERAL REQUIREMENTS

2.1.1 Nuclear Waste Policy Act of 1982

The NWPA established a federal policy for the disposal of spent nuclear fuel and high-level radioactive waste in geologic repositories and assigned to the DOE the responsibility for carrying out that policy. The NWPA directs the DOE to determine, through site characterization, whether Yucca Mountain is a suitable site for a repository. On February 14, 2002, the Secretary of Energy recommended the Yucca Mountain site to the President, thereby ending the site characterization phase of the project. The recommendation process set forth in the NWPA was followed, culminating in the enactment of the Yucca Mountain Development Act on July 23, 2002.

During the remainder of 2002, the ORD continued testing at Yucca Mountain to further refine the understanding of how a repository at Yucca Mountain would perform far into the future. These studies and tests were conducted in a manner that minimizes, to the maximum extent practicable, adverse environmental impacts. To accomplish this, the ORD continued its comprehensive and integrated environmental program to ensure compliance with applicable laws and regulations, collect data and monitor impacts of site activities, and minimize those impacts. The program is described in the YMP *Environmental Management Plan* (YMP 2000).

2.1.2 National Environmental Policy Act of 1969

The National Environmental Policy Act (NEPA) and the regulations that implement the act (40 CFR Parts 1500-1508) establish a process that federal agencies must follow to evaluate and document the potential benefits and consequences of proposed major federal actions on human and natural environments. Those evaluations are conducted to assist agencies in making informed decisions about their proposed actions. DOE has developed regulations (10 CFR Part 1021) for implementing NEPA requirements and to ensure compliance with 35 FR 4247, Protection and Enhancement of Environmental Quality Executive Order 11514.

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Table 1. Permits Applicable to Project Activities in 2002

Regulation Permit Type	Permit Number or Case File	Permit Period	Comments
Materials Act Free Use Permit	N-63370, Borrow Pit #1 N-51530, Coyote Wash Borrow Pit	12/3/99 - 1/6/08 10/26/90 - N/A	Expires when construction ends
Federal Land Policy & Management Act Right-of-Way Reservations ^a Public Land Withdrawal	N-47748 N-48602 N-50250	1/06/88 - 1/6/08 10/10/89 - 1/6/08 9/17/90 - 1/31/10	Renewed January 2001 Renewed January 2001 Withdrawal extended in August 2002
Endangered Species Act Biological Opinion	1-5-96-F-307R	7/23/97 - N/A	Covers scientific testing and site confirmation before repository construction
Biological Opinion	1-5-00-F-518	8/28/01 - N/A	Covers effects of construction, operation, and monitoring of a geologic repository at Yucca Mountain
NAC (Nevada Admin. Code) 503 Scientific Collection Permit	S19260 S21678	1/24/00 - 12/31/01 1/26/02 - 12/31/03	New permit obtained in January 2002
Clean Air Act/NAC 445B Air Quality Operating Permit	AP9611 - 0573 AP9199 - 0573.01	4/26/96 - 4/26/00 7/23/01 - 7/23/06	Renewal application filed March 2000; existing permit remained in effect until new permit issued
Clean Water Act/NAC 445A General Discharge Permit	GNV0022241 - 30054, Stormwater NVR100000, Stormwater	5/14/93-5/14/98 9/16/02-9/15/07	Notice of Intent filed 04/07/98 to continue discharges until 09/30/10. Permit remains in effect until state issues a new permit. Notice of Intent filed 11/18/02 for continuation of coverage under state-issued new Stormwater General Permit
	GENEV9201 - 40037, Septic Tank	7/12/95 - 5/12/98	Permit remains in effect until state issues a new permit (no renewal application required)
Safe Drinking Water Act/NAC 445A Public Water System Permit Underground Injection Control Permit	NY-0867-12NCNT UNEV89031	9/30/02 - 9/30/03 1/30/96 - 1/26/01	Permit renewed annually Renewal application filed July 2000; existing permit remains in effect until state issues a new permit

Table 1. Permits Applicable to Project Activities in 2002 (Continued)

Regulation Permit Type	Permit Number or Case File	Permit Period	Comments
NRS (Nevada Revised Statutes) 533 Water Appropriation Permits	63262-63267	na	Permit applications for permanent water rights: Applications denied. Decision on appeal.
	57373, J-12	4/2/92 - 4/9/02	Expired
	57374, J-13	4/2/92 - 4/9/02	Expired
	57376, J-13	4/2/92 - 4/9/02	Expired
	58827, UE-25C#1	5/13/93 - 4/9/02	Expired
	58828, UE-25C#3	5/13/93 - 4/9/02	Expired
	58829, UE-25C#2	5/13/93 - 4/9/02	Expired
	57375, VH-1	4/2/92 - N/A	Permanent water right. Proof of Application of Water to Beneficial Use for 2.3 acre-feet submitted 4/5/02
	Waivers for borehole NC-EWDP-19D	4/26/00-4/25/03	State Engineer withdrew waiver on 4/9/02
	13-01-0073-X	3/1/01 - 2/28/02	Permit reissued annually
NAC 477 Hazardous Materials Storage Permit	13-02-0073-X	3/1/02 - 2/28/03	

NOTE: ^a List does not include seven Right-of-Way Reservations for small sites in Nevada and California.

The NWPA includes several sections about how NEPA applies to activities at Yucca Mountain. Section 112(b) requires the Secretary of Energy to prepare an Environmental Assessment before nominating a site as suitable for site characterization. This assessment was released in 1986 (DOE 1986). Section 113(d) states that site characterization activities are preliminary decision-making activities; therefore, an EIS was not required for site characterization activities conducted in 2002 or in previous years.

Section 114(f) of the NWPA requires that a final EIS be prepared and included with any recommendation to the President to approve a site as a repository. Therefore, the ORD published a Notice of Intent (60 FR 40164) in 1995 stating its intention to prepare an EIS and to solicit public comments on its scope. The DOE completed the draft EIS in 1999 (DOE 1999). In May 2001, DOE also issued the supplement to the draft EIS (DOE 2001) that evaluated an updated repository design to include an improved understanding of the interactions of potential repository features with the natural environment, the addition of design features for enhanced waste containment and isolation, and evolving regulatory requirements.

As required by the NWPA, the final EIS (DOE 2002b) was submitted with the Secretary of Energy's site recommendation to the President on February 14, 2002. The preferred alternative was to proceed with the Proposed Action, which is to construct, operate and monitor, and eventually close a geologic repository at Yucca Mountain, and to use mostly rail, both nationally and in Nevada, to transport spent nuclear fuel and high-level radioactive waste to the repository. Major conclusions of the final EIS were that the Proposed Action would cause small, short-term public health impacts, primarily from nonradiological traffic fatalities during transport of spent nuclear fuel and high-level radioactive waste from existing commercial and DOE sites to the repository. Long-term impacts to public health from the repository would be very small.

Testing will continue at the site for many years (Section 1.2.3). Data generated from these studies could be used to enhance or modify the proposed repository that was examined in the final EIS (DOE 2002b). To determine whether the impacts from these studies and design enhancements were adequately considered in the final EIS, the ORD developed a procedure to review all post-recommendation activities and design enhancements to determine the possible need for additional NEPA review. Section 114 of the NWPA requires that the NRC adopt, to the extent practicable, the final EIS. Therefore, the procedure addresses provisions of the NRC regulations regarding supplementing the repository EIS (10 CFR Part 63.24[c]). The procedure also implements requirements from DOE Order 451.1B, 40 CFR Parts 1500-1508, and 10 CFR Part 1021.

In accordance with DOE Order 451.1B, an annual summary of NEPA activities conducted by the ORD during 2002 and planned for 2003 was completed in 2003 (Milner 2003).

2.1.3 Atomic Energy Act of 1954

The Atomic Energy Act, as amended, provides fundamental jurisdictional authority to DOE and the NRC over governmental and commercial use of nuclear materials. The act ensures proper management, production, possession, and use of radioactive materials. It grants DOE the authority to develop generally applicable standards for protecting workers, the public, and the

environment from radioactive materials. In accordance with the Atomic Energy Act, DOE has established a system of requirements issued as DOE Orders and codified federal regulations.

There are no YMP work processes that require the monitoring of radioactive effluents into the environment. The Project maintains an inventory of sealed instrument check sources and moisture/density tools for moisture/density measurements and some limited well-logging activities. During 2002, the YMP continued to disposition radioactive sources no longer used or needed.

2.1.4 Executive Order 13148, Greening the Government Through Leadership in Environmental Management

Executive Order 13148 (65 FR 24595) requires integration of environmental accountability into federal agency day-to-day decision making and long-term planning processes. One goal of Executive Order 13148 is to ensure that strategies are established to support environmental leadership programs, policies, and procedures by requiring the implementation of Environmental Management Systems (EMSs) at appropriate federal facilities by December 31, 2005.

In 2001, the Secretary of Energy issued DOE Notice 450.4, which established applicability, requirements, and responsibilities for implementing Executive Order 13148 within the DOE. The provisions of DOE Notice 450.4 apply to all DOE elements responsible for oversight of contracts for the management and operation of DOE facilities and to all contractors. The Notice established the requirements for implementation of an EMS at DOE facilities as part of an Integrated Safety Management System (ISMS).

Several actions were taken in 2002 to implement the EMS requirements in Executive Order 13148 and DOE Notice 450.4. A self-assessment (i.e., gap analysis) of current Project environmental management practices against those in the International Organization for Standards (ISO 1996), the international EMS standard, was completed in March 2002 (Sorensen 2002a). Twelve of 17 criteria in the international EMS standard were being fully implemented, and improvements to processes were needed for full implementation of the remaining 5 criteria. Three of the five criteria needing improvement fell under the "Planning" phase of ISO 14001 (ISO 1996) and included identifying environmental aspects, establishing environmental objectives and targets, and establishing environmental management programs for achieving objectives and targets. A document was issued in July 2002 to implement those criteria (BSC 2002b). A fourth improvement was identified in the "Management Review" phase of the EMS standard. ISO 14001 (ISO 1996) requires top management to periodically review the EMS. To improve and fully implement this criterion, a senior management review of the EMS was integrated into the annual ISMS review. This review was conducted in October 2002 (Wells 2002). This approach is consistent with DOE Notice 450.4, which requires the EMS to be implemented through the ISMS. A fifth improvement identified in the gap analysis was to ensure inclusion of any improvements made (e.g., procedures, reports, etc.) in the EMS documentation. This was accomplished by issuing all documents associated with EMS improvements through procedural processes that ensure proper record keeping and document control.

The review conducted by senior management during the annual ISMS review identified five opportunities for improvement in the EMS (Wells 2002). Action plans to implement those improvements have been prepared and are being tracked in the Condition/Issue Identification & Reporting/Resolution System. Those improvements will be accomplished in calendar year 2003, and include improving the following:

- Dissemination of and training on the environmental policy
- Process for identifying environmental aspects (i.e., developing a procedural process)
- Process for establishing objectives
- Tracking of progress toward targets
- Requirement for “action plans” to achieve objectives and targets.

Other parts of the YMP environmental program comply with other requirements of Executive Order 13148. For example, all requests for authorization to purchase and use chemicals are reviewed to ensure that the least hazardous materials are selected for use and that the possibility of releases of toxic chemicals is reduced or eliminated. Whenever possible, wastes are reduced using recycling and source reduction (Section 3.8.2). Environmental compliance is evaluated through formal assessments (Section 3.9) and surveillances (Section 3.10). Environmental accountability is integrated into daily functions and planning as part of the YMP ISMS and by instilling environmental and pollution-prevention awareness during training programs (Section 3.11) and presentations (Section 3.8.3). Protection of resources on ORD-controlled land is achieved through land-access reviews (Section 3.1), biological surveys and reclamation (Sections 3.2 and 3.3), identification and conservation of cultural resources (Section 3.4), environmental regulatory compliance (Sections 3.5 through 3.8), and assessment and surveillance programs (Sections 3.9 and 3.10).

2.1.5 Executive Order 13101, Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition

Executive Order 13101 (63 FR 49643) establishes purchasing guidelines and reporting requirements for federal agencies. It expands and strengthens the federal government's commitment to recycling and requires that, whenever possible, federal agencies procure environmentally preferable products and services and purchase recycled-content products identified by the EPA. The YMP affirmative procurement program is described in Section 3.8.3.

2.1.6 Executive Order 13123, Greening the Government Through Efficient Energy Management

Executive Order 13123 (64 FR 30851) requires federal facilities to reduce emissions of greenhouse gases, improve energy efficiency and water conservation, and expand the use of renewable energy. This Executive Order requires that sustainable-design principles be applied to the siting, design, and construction of new facilities. The Project's efforts to comply with this Executive Order are described in Section 3.8.

2.1.7 Executive Order 13149, Greening the Government Through Federal Fleet and Transportation Efficiency

Executive Order 13149 (65 FR 24607) requires federal facilities to reduce the consumption of petroleum fuels through the use of alternative fuels and the acquisition of vehicles with higher fuel economy. The purchase and use of environmentally preferable automotive products, such as retread tires and re-refined motor oils, is also required by Executive Order 13101. As described in Section 3.8.3, efforts to implement Executive Order 13149 on the YMP to date include the purchase of fuel-efficient and alternative-fuel vehicles, designation of a compressed natural gas refueling facility, and the purchase of retread tires for large trucks and heavy equipment.

2.2 LAND USE

2.2.1 Federal Land Policy and Management Act of 1976

The Federal Land Policy and Management Act establishes federal policy for government-owned lands administered by the BLM and mandates that these lands be managed in a way that will protect environmental quality, preserve certain lands in their natural condition, and provide for outdoor recreation and human occupancy and use. Because some YMP activities are conducted on BLM-administered public land, the ORD must comply with BLM requirements for access to and use of that land.

Access for site characterization activities on BLM-administered land and U.S. Air Force-administered BLM land at Yucca Mountain was granted in Right-of-Way Reservations (ROWRs) issued in January 1988 and October 1989, respectively (BLM 1988, 1989). The ROWR for the U.S. Air Force-administered BLM land was subsequently renewed in June 1994 (BLM, 1994). In January 2001, both ROWRs were renewed for 7 years (Wells 2001a, 2001b, 2001c). The ROWR for U.S. Air Force-administered BLM land will require additional concurrence from the U.S. Air Force and a Notice to Proceed from the BLM by April 2004 (Wells 2001c).

The BLM also has withdrawn public lands at Yucca Mountain from the mining and mineral-leasing laws. The 4,256-acre withdrawal overlays part of the BLM-administered land previously discussed and was obtained to preclude the filing of mining claims at Yucca Mountain. This withdrawal was obtained in 1990 and expired September 25, 2002 (55 FR 39152); it was extended in 2002 until January 31, 2010, by Public Land Order 7534 (67 FR 53358). Over the years, the ORD acquired 45 ROWRs from the BLM for sites scattered throughout Nevada and southern California where seismic, radiation, or streamflow monitoring stations were established or where pits have been developed to study volcanism and faulting. Most of these sites are less than 0.3 acres. Seven of the ROWRs were still active at the end of 2002. The other 38 ROWRs were either transferred to other agencies or the equipment was dismantled, the site reclaimed, and the ROWR identified to the BLM for relinquishment.

All BLM ROWRs require that the YMP comply with applicable environmental laws and regulations. Environmental program activities described in Section 3 are, therefore, conducted on all ROWRs, as applicable. BLM also requires the DOE to recontour and revegetate disturbed

sites before relinquishing them and to monitor growth of vegetation on those sites until reclamation success criteria are achieved. As described in Section 3.3, the YMP conducted reclamation when applicable and as agreed upon with the BLM at sites relinquished in 2002.

2.2.2 Materials Act of 1947

The Materials Act authorizes the BLM and other land management agencies to issue free-use permits to federal and state agencies for use of common varieties of sand, stone, and gravel on public lands. Since 1990, the BLM has issued the YMP three free-use permits to excavate sand and gravel. One of the permits is for a borrow pit in Coyote Wash that has not been developed. The second permit, for a borrow pit near Fortymile Wash, was allowed to expire in 2001 after recontouring and reclamation had been completed. The third, for Borrow Pit #1 east of Fran Ridge, was to expire in 2001; the ORD applied to the BLM for a renewal in 1999. A renewal of that permit, valid for 7 years, was granted in February 2000 (Drais 2000). As described in the annual report to the BLM, 2,004 cubic yards (1,533 cubic meters) of material were removed from that pit in 2002 (Wade 2002a).

2.3 BIOLOGICAL RESOURCES

2.3.1 Endangered Species Act of 1973

The Endangered Species Act requires federal agencies to consult with the U.S. Fish and Wildlife Service to ensure that their actions do not jeopardize the continued existence of threatened or endangered species or destroy or adversely modify their critical habitats. This act also prohibits killing, injuring, or otherwise taking a threatened or endangered species, unless that taking is incidental to an otherwise lawful act and conducted in accordance with an incidental take provision issued by the Service. The desert tortoise is the only threatened or endangered species at Yucca Mountain; the site is not classified as critical habitat for this threatened species.

The ORD initially consulted with the U.S. Fish and Wildlife Service about the effects of site characterization activities on desert tortoises in 1989. In 1996, the ORD reinitiated formal consultation to allow the Service to clarify its interpretation of take, revise the incidental take limit, and reevaluate terms and conditions for relocating tortoises. In a 1997 biological opinion, the Service again concluded that it was unlikely that completion of site characterization and related activities would jeopardize the species. Consequently, the Service revised the terms and conditions the YMP must follow to legally and incidentally take desert tortoises (Buchanan 1997). That biological opinion and incidental take provision were applicable to all YMP activities conducted during 2002.

The 1997 incidental take provision requires that the YMP minimize harm to tortoises by conducting preactivity and clearance surveys, removing tortoises and tortoise nests from construction sites, designing and monitoring escapable trenches, controlling litter, setting speed limits, reclaiming habitat, and implementing a worker-education program. Many parts of the integrated environmental program described in Section 3 are conducted to comply with these requirements. For example, litter control, design of trenches, and other requirements are incorporated into projects during land access evaluations (Section 3.1). Surveys are conducted to

find and protect tortoises (Section 3.2). Reclamation of desert tortoise habitat is conducted as described in Section 3.3. The training program described in Section 3.11 includes information about the conservation and protection of desert tortoises.

No desert tortoises were killed or injured by site activities during 2002. An annual report of activities conducted to comply with the incidental take provision was submitted to the U.S. Fish and Wildlife Service in February 2003 (Wade 2003a).

The ORD also consulted with the U.S. Fish and Wildlife Service on the effects of construction, operation, monitoring, and closure of a geological repository at Yucca Mountain. The U.S. Fish and Wildlife Service concluded that those actions are not likely to jeopardize the continued existence of the desert tortoise. The resulting biological opinion (Williams 2001) would take effect only if the NRC authorized construction of the repository. The YMP will continue to rely upon the 1997 biological opinion (Buchanan 1997) to comply with the Endangered Species Act for all future scientific testing, site confirmation, and similar activities that occur before any authorization to construct a repository.

2.3.2 Migratory Bird Treaty Act

The Migratory Bird Treaty Act implements various treaties and conventions between the U.S. and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Taking, killing, or possessing migratory birds is unlawful under this act unless permitted by the U.S. Fish and Wildlife Service.

Surveys at Yucca Mountain are conducted before clearing vegetation (Section 3.2), in part to ensure that migratory birds are not harmed during those activities. In addition, facilities such as water tanks are inspected during surveillances (Section 3.10) to ensure that migratory birds are not being trapped or otherwise harmed.

2.3.3 Nevada State Wildlife Statutes

Nevada Administrative Code (NAC) 503 prohibits capturing or harming species classified as protected by Nevada without a permit. The desert tortoise is classified in Nevada as threatened with extinction and has been placed on the state list of fully protected species. Because the YMP is required to remove desert tortoises that may be harmed by Project activities, BSC maintains a permit issued by the Nevada Division of Wildlife for the capture and relocation of desert tortoises (Nevada Division of Wildlife 2000, 2002). That permit also allows BSC to capture and possess other species for wildlife monitoring studies at Yucca Mountain. No tortoises or other wildlife were captured or possessed under this permit in 2002. An annual report was submitted to the Nevada Division of Wildlife in January 2003 (Green 2003).

2.3.4 Executive Order 13112, Invasive Species

Executive Order 13112 (64 FR 6183) was developed to prevent and control the introduction of invasive, nonnative species to minimize economic, ecological, and human-health impacts. Applicable portions of the Executive Order require the YMP to prevent the introduction of invasive species, monitor and control those species, restore native species, and exercise care when taking actions that could promote the introduction or spread of invasive species.

In part to implement this Executive Order, disturbed sites are revegetated as soon as possible after decommissioning to reduce the time available for invasive plant species to become established. Native perennial species are seeded or planted during reclamation to reduce colonization of invasive plants. The abundance of nonnative species on reclaimed sites is then monitored periodically, and control efforts such as weeding and reseeding of native perennials may be implemented to reduce the abundance of invasive species. As mentioned in Section 3.3.3, 26 sites totaling 7.4 acres were reclaimed in 2002 and 129 previously reclaimed sites were monitored.

2.4 CULTURAL RESOURCES

The National Historic Preservation Act of 1966 is the principal law regulating the protection of historic properties and cultural resources at Yucca Mountain. Others include the Archaeological Resources Protection Act of 1979; Antiquities Act of 1906; American Indian Religious Freedom Act of 1978, as amended; Native American Graves Protection and Repatriation Act of 1990; and 36 CFR Part 79. In addition, the YMP operates to Executive Order 11593 (36 FR 8921), Executive Order 13007 (61 FR 26771), Executive Order 13084, (63 FR 27655), and the *American Indian and Alaska Native Tribal Government Policy* (DOE 2000). Many of these regulations address cultural values and beliefs of Native Americans and protect and preserve their religious rights and practices. The goals of these laws are to ensure that historic properties and cultural values are considered when planning and conducting federal activities and that adverse effects on significant historic properties and matters of concern to Native Americans are identified and mitigated.

Compliance with most of these statutes, regulations, and Executive Orders is accomplished through a *Programmatic Agreement Between the United States Department of Energy and the Advisory Council on Historic Preservation for the Nuclear Waste Deep Geologic Repository Program Yucca Mountain, Nevada* (DOE 1988), which was executed between the DOE and the Advisory Council on Historic Preservation. The Programmatic Agreement requires the YMP to give the Nevada State Historic Preservation Officer (SHPO) the opportunity to participate in monitoring compliance with the Agreement. Although the SHPO is not a signatory to the Programmatic Agreement, the DOE has invited the SHPO to participate. The YMP sends copies of all survey reports, data recovery plans, and annual reports to the SHPO. In 2002, representatives of the SHPO actively participated in oversight and review of the program, commenting on numerous survey reports and participating in discussions of future work plans at Yucca Mountain.

The Programmatic Agreement also required the YMP to develop and implement a comprehensive research plan for recovering, documenting, and interpreting data from historical properties. The *Research Design and Data Recovery Plan for Yucca Mountain Project* (DOE 1990) was developed and implemented to meet that requirement. Activities conducted in 2002 to implement that plan are described in Section 3.4.1.

All personnel working at Yucca Mountain must be informed of their responsibilities for protecting archaeological resources. That training is described in Section 3.11.

To comply with the Programmatic Agreement, the ORD also must consult with certain Native American tribes and organizations regarding religious and cultural concerns about historical properties. The ORD conducts a Native American Interaction Program with 16 tribes and one Native American organization that have traditional ties to the Yucca Mountain area. Interactions conducted during 2002 are described in Section 3.4.3.

Finally, the YMP must provide the SHPO and the Advisory Council on Historic Preservation with regular reports concerning implementation of the Programmatic Agreement. A report summarizing DOE and contractor activities to implement the stipulations of the Programmatic Agreement during calendar year 2002 will be submitted in 2003.

2.5 AIR QUALITY

Activities affecting air quality at Yucca Mountain are regulated by the Clean Air Act of 1977, as amended. That act requires, among other things, compliance with national air quality standards, permits for operating air pollution sources, and limits on emissions of certain hazardous air pollutants.

40 CFR Part 63 did not apply to YMP activities conducted in 2002. These federal regulations set forth emission limits and other requirements for activities that generate emissions of certain types of hazardous air pollutants. No pollutants covered by these regulations have been emitted by YMP activities to date.

The Nevada Division of Environmental Protection is responsible for implementing and enforcing most other requirements of the Clean Air Act in Nevada. State regulations (NAC 445B) require an air quality operating permit for large generators and other point sources of air pollution and for activities that are projected to disturb more than 20 acres. The ORD has held an operating permit for land disturbances since 1991 and has obtained permits, as needed, for the operation of generators and other emission sources. In mid-1995, the state consolidated those permits into a single Class II air quality operating permit (Johnson 1995). A new Class II air quality operating permit was issued to the Project on July 23, 2001 (Elges 2001).

On December 20, 2002, the DOE submitted an Administrative Amendment to revise the Class II permit. The amendment requested a project name change from Yucca Mountain Site Characterization Office to the Office of Repository Development. It also requested a name change from J. Russell Dyer to W. John Arthur, III, for the responsible official. On February 19, 2003, the state revised the permit to reflect the changes (Regan 2003).

Ten systems (i.e., generators and other emission sources) were permitted under the new air quality operating permit. As required, an annual report summarizing emissions during 2002 was submitted to the Nevada Division of Environmental Protection in February 2003 (Wade 2003b).

Because of a reduction in site activities, only 0.02 tons of reportable air pollutants were emitted from the 10 permitted systems during 2002. The maximum allowed under a Class II permit is 100 tons.

The air quality operating permit requires the YMP to control fugitive dust. This was done throughout 2002 by applying water to disturbed areas. In addition, disturbed areas no longer required for the YMP were reclaimed (Section 3.3).

Before 1999, the air quality operating permit stipulated that the DOE must sample ambient air for inhalable particulate matter 10 micrometers or less in diameter (known as PM₁₀). Although no longer required by the permit, the YMP continues to monitor PM₁₀ because of its importance in establishing trends and detecting changes in air quality. The number of sites was reduced from three to two after April 2002. The PM₁₀ air quality conditions had been adequately established at the discontinued site in Jackass Flats along Fortymile Wash near the J-12 well. Section 3.5 describes that program and the results of monitoring in 2002.

The Clean Air Act also regulates the service, maintenance and repair, and disposal of appliances and air conditioning systems from motor vehicles that contain Class I and Class II ozone-depleting substances (40 CFR Part 82). YMP technicians who repair or service those systems are certified and follow procedures to minimize releases of ozone-depleting substances.

2.6 WATER QUALITY AND AVAILABILITY

2.6.1 Clean Water Act of 1977

The Clean Water Act of 1977, as amended, establishes federal policy for restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. Regulations that implement the act address effluent discharges, water quality standards, and discharges of oil and hazardous substances into surface water. Only those parts of the act that regulate discharge of liquid effluents to the surface (including stormwater) and discharge of dredged or fill material were applicable to the YMP in 2002.

Permits to discharge liquid effluents are issued pursuant to the National Pollutant Discharge Elimination System (40 CFR Part 122). Implementation and enforcement of this portion of the Clean Water Act are delegated to the Nevada Division of Environmental Protection (NAC 445A). During 2002, the YMP operated under general discharge permits issued in May 1993 and September 2002 for stormwater discharges from construction sites (Brandmueller 1994; Lawson 2002) and in July 1995 for sanitary sewage discharges to a septic tank and leachfield (Saunders 1995). The septic tank permit expired in 1998, but the Nevada Division of Environmental Protection has stated that the permit will remain in effect until a new permit is issued.

Effective September 16, 2002, the new stormwater general permit includes more stringent requirements for sediment and erosion control from construction sites. In November 2002, work was initiated on a Stormwater Pollution Prevention Plan to address new requirements of this stormwater general permit, including weekly inspections. As described in the plan, several types of controls have been included in the design to limit stormwater pollution. These controls must be inspected weekly to ensure that they are functioning as planned. The plan was effective March 28, 2003.

Section 404 of the Clean Water Act requires that a permit be obtained from the U.S. Army Corps of Engineers before placing dredged or fill materials into washes that are classified as waters of

the United States (33 CFR Part 320). To ensure compliance with this requirement, all new surface-disturbing activities are evaluated as part of the land access process (Section 3.1). One activity conducted in 2002 required that fill material be placed in a dry wash that may be classified as a water of the United States. That activity was allowed by Nationwide Permit 5, Scientific Measurement Devices, issued by the U.S. Army Corps of Engineers in 1996 (61 FR 65874) (Section 3.2).

2.6.2 Safe Drinking Water Act of 1974, as Amended

The Safe Drinking Water Act gives the EPA responsibility and authority to regulate public drinking water supplies by establishing drinking water standards, delegating to states the authority for enforcing those standards and protecting aquifers from such things as injection of wastes and other materials into wells.

The Nevada Bureau of Health Protection Services, Division of Health, enforces drinking water standards (NAC 445A). The water supply system at Yucca Mountain is classified as a public water supply, and an annual permit to operate that system was first granted in April 1996. The permit is renewed annually (Nevada State Division of Health 2002).

All drinking water for the site comes from Wells J-12 and J-13. On April 9, 2002, water appropriation permits for Wells J-12 and J-13 expired. After this date, no water was pumped from these wells for use at Yucca Mountain during the remainder of 2002. This system was then operated with the existing water in the distribution system. Daily pH and chlorine residual measurements were taken from water in the system, as well as weekly samples for coliform bacteria.

As required by these permits, quarterly results of coliform sampling were submitted to the state; all samples were negative. Annual sampling for nitrate and fluoride was not conducted because water could not be pumped from the water well where the sampling port is located. Sampling and other activities conducted during 2002 to comply with the permit are summarized in a report submitted to the Nevada Division of Health in January 2003 (Wade 2003c).

Another component of the Safe Drinking Water Act applicable to the YMP in 2002 was the underground injection control program (40 CFR Part 144). This program was established to prevent contamination of underground sources of drinking water from improper design, construction, and operation of injection wells. The State of Nevada has EPA-granted authority to administer this program (NAC 445A), which requires a permit before tracers can be injected into drillholes or used in infiltration studies. To comply with this program, the YMP has a permit issued by the Nevada Division of Environmental Protection (Land 1998). This permit authorizes injection of water and various tracers, including gas, into 103 boreholes; discharges from the concrete batch plant to a lined pond; discharges to an infiltration basin; and the use of filtered waste water from the Exploratory Studies Facility for dust suppression.

As required by the underground injection control permit, quarterly reports were submitted to the Nevada Division of Environmental Protection. These reports list the volume of fluid produced or discharged per month; the type, quantity, and concentration of tracer(s) injected per month; tracer test summaries; the results of chemical analyses from the oil-water separator, lithium

bromide wastewater, and water discharges traced with lithium bromide; and the analytical results of semiannual sampling of drinking water from Well J-13. An annual report summarizing all 2002 activities for this permit was submitted in January 2003 (Wade 2003d).

The underground injection control permit expired on January 26, 2001. An application to renew the permit was submitted in 2000 (Wade 2000) and was deemed complete by the Nevada Division of Environmental Protection. As provided in Nevada regulations, the YMP will continue to operate legally under the expired permit until a new permit is issued.

2.6.3 Nevada Statutes for Appropriation of Public Waters

Use of groundwater in Nevada requires a permit from the Nevada State Engineer. The Nevada State Engineer reviews permit applications to determine whether water is available at the source, the proposed use conflicts with existing water rights, or the proposed use threatens to prove detrimental to the public interest (NRS 533).

In March 1992, the Nevada State Engineer issued temporary water-appropriation permits to the DOE for up to 430 acre-feet per year from Wells J-12 and J-13 (Turnipseed 1992a, 1992b, 1992c). These temporary permits expired in April 2002. Prior to the April 2002 expiration, about 12.8 acre-feet of water were pumped from these wells and put to beneficial use. These and subsequent water appropriation permits were subject to a stipulation that DOE conduct regional water-level monitoring. This program is described in Section 3.7.

A permanent water appropriation permit was issued to DOE in April 1992 for Well VH-1 for approximately 61 acre-feet per year (Turnipseed 1992d). This amount is part of the total DOE appropriation limit of 430 acre-feet annually. During 2002, 257,000 gallons of water were pumped from Well VH-1 and used for dust control and reclamation. According to a stipulation in the Well VH-1 permit, the DOE had 10 years (until April 9, 2002) to prove beneficial use of the water. On April 5, 2002, a Proof of Application of Water to Beneficial Use for 2.3 acre-feet was submitted to the State Engineer (Wade 2002b).

In June 1993, the Nevada State Engineer issued temporary water-appropriation permits for Wells C-1, C-2, and C-3, which comprise the C-Well Complex at Yucca Mountain (Turnipseed 1994a, 1994b, 1994c). During 2000, the Nevada State Engineer granted an extension for the three wells through April 9, 2002, after which they expired. No water was pumped from these wells in 2002.

On July 22, 1997, the DOE filed a water appropriation request with the Nevada State Engineer for permanent rights to 430 acre-feet annually in order to meet the DOE's responsibilities under the NWPA beyond April 2002. In February 2000, the Nevada State Engineer ruled against the DOE's water appropriation request for permanent rights on the grounds that the requested use is detrimental to the public interest of the citizens of Nevada. During 2002, DOE legal appeals continued on the Nevada State Engineer's ruling (Section 2.9).

A two-year waiver was granted in April 2001 authorizing up to 120 million gallons (about 370 acre-feet) of groundwater discharge from Borehole NC-EWDP-19D for hydraulic and cross-hole tracer testing. Under this waiver, a total of 3,142,111 gallons (about 9.6 acre-feet) was pumped from Borehole NC-EWDP-19D during the first quarter of 2002. On April 2, 2002,

the ORD was notified by the State Engineer that the waiver would expire on April 9, 2002 (Ricci 2002). No groundwater was discharged after April 9, 2002.

2.6.4 Executive Order 11988, Floodplain Management

Executive Order 11988 (42 FR 26951) requires that federal agencies develop regulations to evaluate the potential effects of their actions on flood hazards and floodplain management and avoid floodplain impacts to the extent practicable. The DOE has developed regulations to implement this Executive Order (10 CFR Part 1022). These regulations require a public notice of all activities that are proposed within a floodplain, an evaluation of practical alternatives and design changes, a floodplain assessment, and a published statement of findings.

The DOE published a Notice of Floodplain/Wetlands Involvement for site characterization activities in 1989 (54 FR 6318). Two floodplain assessments for YMP activities at Yucca Mountain were then prepared (YMP 1991, 1992), and the associated statements of finding were published (56 FR 49765; 57 FR 48363). These actions meet the requirements of Executive Order 11988 for all activities that occurred at Yucca Mountain during 2002.

In June 1999, the DOE published 64 FR 31554 for activities associated with construction of a geologic repository at Yucca Mountain. A *Floodplain/Wetlands Assessment for the Proposed Yucca Mountain Geologic Repository* was included as Appendix J of the Final EIS (DOE 2002b).

2.6.5 Executive Order 11990, Protection of Wetlands

Executive Order 11990 (42 FR 26961) requires federal agencies to develop regulations for considering wetlands protection during the decision-making process for their proposed actions. The DOE's regulations for implementing this Executive Order are at 10 CFR Part 1022.

There are no wetlands at Yucca Mountain; therefore, the regulations in 10 CFR Part 1022 do not apply to site activities conducted during 2002.

The DOE concluded in the *Floodplain/Wetlands Assessment for the Proposed Yucca Mountain Geologic Repository* (DOE 2002b, Appendix J) that a wetlands assessment was not required for construction of a repository because there are no wetlands at Yucca Mountain.

2.7 HAZARDOUS AND SOLID WASTES AND MATERIALS

2.7.1 Federal Facility Compliance Act of 1992

The Federal Facility Compliance Act amends portions of the Resource Conservation and Recovery Act of 1976 (RCRA) to require compliance by federal facilities with federal, state, and local laws and regulations related to solid and hazardous wastes. In addition, the Federal Facility Compliance Act waives the federal government's sovereign immunity for violations of federal, state, and local laws and regulations related to solid and hazardous wastes. The YMP complies with all applicable laws and regulations related to solid and hazardous wastes, as described in Section 2.7.4.

2.7.2 Comprehensive Environmental Response, Compensation, and Liability Act of 1980

The Comprehensive Environmental Response, Compensation, and Liability Act provides a framework for the cleanup of sites containing hazardous wastes that present a substantial danger to the public. As amended in 1986 by the Superfund Amendments and Reauthorization Act, it also requires emergency notification and response for release of a hazardous substance that exceeds threshold quantities. Executive Order 12580 (52 FR 2923), delegates to heads of executive departments and agencies the responsibility for undertaking remedial actions for releases or threatened releases that are not on the National Priority List and removal actions other than emergencies where the release is from any facility under the jurisdiction or control of executive departments and agencies. If a reportable quantity of a hazardous substance is released into the environment, the DOE will immediately notify the National Response Center and the State of Nevada and initiate clean-up activities. There were no releases in 2002 that exceeded reportable thresholds under both the Comprehensive Environmental Response, Compensation, and Liability Act and the State of Nevada requirements in NAC 445A.

2.7.3 Emergency Planning and Community Right-to-Know Act of 1986

The Emergency Planning and Community Right-to-Know Act (EPCRA); NAC 477, and NAC 459 establish the planning, notification, permitting, and reporting requirements for hazardous substances and chemicals that are produced, used, stored, handled, transported, or released by the YMP.

Sections 302, 311, and 312 of the EPCRA require, among other things, that the owner or operator of a facility report quantities stored and releases of specified chemicals to the State Emergency Response Commission, Local Emergency Planning Committee, and local fire department with jurisdiction over a facility. Those sections also require that Material Safety Data Sheets be provided to those organizations. To meet those requirements, information on hazardous materials and chemicals at the YMP in 2002 was reported in the *Nevada Combined Agency Hazmat Facility Report* (Wade 2002c). This report is prepared annually in accordance with NAC 477 and submitted to the Nevada Office of the State Fire Marshal, Nevada State Emergency Response Commission, Nye County Local Emergency Planning Committee, and local fire protection services (Section 3.8). That report also serves as the application for renewal of the Nevada hazardous materials storage permit.

EPCRA Section 304 requires the owner of a facility that produces, uses, or stores a hazardous chemical to immediately notify the State Emergency Response Commission and Local Emergency Planning Committee of a release of specified hazardous substances that is not federally permitted, exceeds the reportable quantity, and results in exposure to persons offsite. There were no releases of specified hazardous substances during 2002.

Section 313 of EPCRA requires certain owners or operators of facilities that manufacture, process, or otherwise use listed toxic chemicals in excess of established thresholds to submit annual reports on the amounts of those chemicals released into the environment. The YMP did not manufacture, process, or otherwise use any chemicals regulated under Section 313 of EPCRA in excess of threshold quantities.

NAC 459 requires facility owners and operators that produce, use, store, or handle highly hazardous substances in amounts that equal or exceed threshold quantities to register with the Nevada Division of Environmental Protection and develop a management system for these substances. In 2002, the YMP did not meet or exceed any threshold quantities for highly hazardous substances and was not required to register.

2.7.4 Resource Conservation and Recovery Act of 1976 and Associated Regulations

The RCRA is a comprehensive program for regulating and managing hazardous wastes (Subtitle C), nonhazardous solid wastes (Subtitle D), and underground storage tanks (Subtitle I), and promoting the use of recycled and recovered materials (Subtitle F). RCRA's primary goals are to protect human health and the environment from the potential hazards of waste disposal, conserve energy and natural resources, reduce the amount of waste generated, and ensure that wastes are managed in an environmentally sound manner. RCRA sets a federal policy of restricting land disposal of untreated hazardous wastes in favor of environmentally preferred alternatives such as treatment, source reductions, and recycling. Regulations promulgated under RCRA define hazardous wastes and specify requirements for their transport, handling, treatment, storage, and disposal. Section 6001 of RCRA requires federal agencies to comply with all federal, state, interstate, and local requirements relating to the control and abatement of solid and hazardous waste disposal.

Subtitle C—In 1985, the EPA authorized Nevada to administer Subtitle C of RCRA (managing hazardous waste). The Nevada Division of Environmental Protection is the agency responsible for administering this part of RCRA (NAC 444). Activities at the Yucca Mountain site generate more than 220 pounds, but less than 2,204 pounds per month of RCRA-defined hazardous wastes; therefore, the site is regulated under the act as a small-quantity generator. The YMP submitted a "Notification of Hazardous Waste Activity" to the Nevada Division of Environmental Protection for the generation of hazardous waste at the Yucca Mountain site in 1989 and received EPA identification number NV7890090023. Activities at the YMP's Las Vegas office facilities generate less than 100 kilograms (220 pounds) per month of RCRA-defined hazardous wastes; therefore, the site is regulated under the act as a conditionally exempt small quantity generator.

State of Nevada regulations also require small quantity generators to complete a biennial hazardous waste report. The report identifies the types and quantities of hazardous waste generated and transported offsite for treatment, storage, or disposal by the YMP and is used to track national trends in waste management practices. A biennial hazardous waste report was not required for waste management activities in 2002.

Subtitle D—Nonhazardous solid waste is regulated by Nevada pursuant to Subtitle D of RCRA (NAC 444). Refuse, along with salvageable, industrial, and special nonhazardous waste, were recycled or disposed of during 2002 in accordance with these regulations (Table 6, Section 3.8.2).

Subtitle F—Subtitle F of RCRA requires that federal agencies comply with all federal, state, interstate, and local requirements stemming from RCRA, unless exempted by the President. The YMP complies with the requirements of RCRA as described above. Subtitle F also encourages

the federal government to institute a procurement policy that encourages the purchase of recoverable materials, which, because of their performance, can be substituted for virgin material at a reasonable price. YMP compliance with the procurement policy is discussed in Section 3.8.3.

Subtitle I—Management of the RCRA underground storage tank program has been delegated to Nevada (NAC 459). Because YMP activities do not require the use of underground storage tanks regulated by Subtitle I, this section is not applicable.

2.7.5 Toxic Substances Control Act

The Toxic Substances Control Act authorizes the EPA to require testing of new chemical substances that enter the environment and to regulate those chemicals when necessary. This act complements and expands existing toxic substance laws such as Section 112 of the Clean Air Act and Section 307 of the Clean Water Act. This act also regulates certain toxic substances, specifically polychlorinated biphenyls, chlorofluorocarbons, asbestos, dioxins, certain metal-working fluids, and hexavalent chromium. In 2002, there were no YMP activities subject to this act.

2.7.6 Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act requires that all pesticides used in the U.S. be submitted for registration by the EPA. To be approved for registration, the active ingredients in pesticides must meet criteria regarding the quantity, quality, and impact upon the environment. No manufacturer or importer may make or sell a product for use to control pests unless the compound is registered with the EPA. Pesticide applications for the YMP are performed by licensed contractors who are required to be in full compliance with all local, state, and federal rules and regulations, including those in the Federal Insecticide, Fungicide, and Rodenticide Act.

2.8 DOE POLICIES AND ORDERS

The following DOE Policies and Orders were directly applicable to the environmental program conducted by the ORD during 2002.

DOE Policy 450.4 describes objectives, guiding principles, and core functions of an ISMS to be implemented throughout the DOE complex. DOE acquisition regulations (48 CFR Part 970) require contractors to manage and perform work in accordance with a documented ISMS. BSC documents its processes and mechanisms for implementing ISMS in an Integrated Safety Management description document that is updated annually and submitted to DOE per contractual requirement (Anderson 2002). That document describes the successful implementation of ISMS objectives throughout BSC operations and includes the results of a review conducted in 2002 by BSC senior managers and DOE representatives to evaluate BSC compliance with these objectives. DOE accepted the updated Description Document to indicate approval of BSC's ISMS program implementation.

DOE Policy 450.5 is the DOE policy for line management oversight of environment, safety and health (ES&H) and for the use of contractor self-assessment programs to implement that oversight. Section 3.9 describes the YMP environmental assessment program.

DOE Order 231.1 establishes requirements to ensure that ES&H information required by law or regulation, or essential for evaluating operations and identifying opportunities for improvements, is collected and reported. This site environmental report and an annual NEPA planning summary (Section 2.1.2) are the reporting requirements of this Order applicable to the YMP environmental program.

DOE Notice 231.1 sets forth the requirements and responsibilities for DOE elements to prepare annual summary reports for the Secretary of Energy on the results of ES&H assessments conducted in the previous year. The Notice also implements the revised requirements of 29 CFR Part 1904, "Recording and Reporting Occupational Injuries and Illnesses," within DOE to ensure the collection and reporting of occupational injury and illness information required by law or essential for evaluating DOE operations.

DOE Order 451.1B describes DOE's requirements and responsibilities for implementing the NEPA, the Council on Environmental Quality Regulations Implementing the Procedural Provisions of NEPA (40 CFR Parts 1500-1508), and the DOE NEPA Implementing Procedures (10 CFR Part 1021). Section 2.1.2 includes a summary of actions taken by the ORD to comply with NEPA and this order.

DOE Order 5400.1 establishes requirements, authorities, and responsibilities for environmental protection program for DOE operations to ensure compliance with applicable federal, state, and local environmental laws and regulations, Executive Orders, and DOE policies. This Order more specifically defines the environmental protection requirements established in DOE Order 5480.4. DOE Order 5400.1 also requires environmental monitoring programs. The comprehensive environmental program described in this site environmental report implements the requirements of DOE Order 5400.1. (DOE Order 5400.1 was canceled January 15, 2003, by DOE Order 450.1.)

DOE Order 5400.5 establishes limits and requirements for a variety of scenarios involving potential exposure to radiation. Also covered are the radiological monitoring requirements for the sale or release of equipment or material potentially contaminated by radiation. Project equipment that was historically transferred from the Nevada Test Site with no documented radiation survey, and which is scheduled for release to the general public, is surveyed in accordance with this Order. The Project does not release any item having levels of residual radioactive contamination greater than those listed in this Order and no radioactive contamination was identified in 2002. Consequently, the requirement in the guidelines for the preparation of site environmental reports (Lawrence 2003) to discuss approved release limits, dose estimates, radionuclide concentrations, and expected end-use scenarios are not applicable.

DOE Order 5480.4 specifies requirements for mandatory ES&H standards applicable to all DOE and DOE-contractor operations, lists reference ES&H standards, and identifies the sources of the mandatory environmental standards. The mandatory standards listed in this Order that were applicable to the YMP during 2002 are the laws and regulations described in this section.

DOE Notice 450.4 assigns responsibilities for implementing Executive Order 13148. See Section 2.1.4 for details about the implementation of this Notice. (This Notice was canceled January 15, 2003, by DOE Order 450.1.)

2.9 PERMIT ASSOCIATED LITIGATION

2.9.1 History

On February 2, 2000, the Nevada State Engineer denied DOE's water appropriation request for 430 acre-feet per year for use at Yucca Mountain based on a finding that the requested use threatened to prove detrimental to the public interest (Turnipseed 2000). DOE filed suits on March 2, 2000, in the U.S. District Court for the District of Nevada, and on March 3, 2000, in Nevada's Fifth Judicial District Court, for injunctive relief to overturn the Nevada State Engineer's ruling.

On September 21, 2000, a U.S. District Court Judge granted the State's motions to dismiss the DOE lawsuit. DOE appealed this ruling on November 16, 2000. On October 15, 2001, the Ninth U.S. Circuit Court of Appeals ordered a federal judge to hear the DOE's suit.

2.9.2 2002 Developments

In March 2002, the DOE amended its complaint in the U.S. District Court to include an appeal of the denial of an extension to the temporary water rights that were to expire in April 2002. On November 27, 2002, the DOE filed a motion for summary judgement with the U.S. District Court seeking to resolve the litigation in the DOE's favor. In December 2002, the Nevada parties filed a motion to stay the proceedings.

In April 2002, DOE filed a Motion for Preliminary Injunction in U.S. District Court seeking to ensure continued access to water at the Yucca Mountain site while the DOE appeal of the State Engineer's rulings on the permit requests proceeds. A hearing was held on June 11, 2002, on the Preliminary Injunction. The Court denied DOE's Motion, without prejudice, based on a finding that DOE had failed to show irreparable harm at that point.

On December 3, 2002, the DOE filed a Renewed Motion for Preliminary Injunction with the U.S. District Court, District of Nevada, to stop the State of Nevada from interfering with the DOE's effort to replenish the potable water supply at Yucca Mountain. On December 19, 2002, the State of Nevada and the DOE agreed to a joint stipulation that allowed DOE to re-supply the potable water storage tanks at Yucca Mountain, as needed.

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3. ENVIRONMENTAL PROGRAMS

This section describes the environmental program conducted during 2002 to implement the requirements of environmental permits described in Section 2, monitor impacts of the Project, and protect the environment at Yucca Mountain. The organization, responsibilities, and requirements of this program are described in greater detail in the *Environmental Management Plan* (YMP 2000).

All aspects of this environmental program are conducted in accordance with the YMP ISMS. During the planning stage of all Project activities, potential impacts to the environment are identified and measures to mitigate those impacts, including pollution prevention and environmental protection practices, are developed. These measures, clear roles and responsibilities for conducting work and ensuring compliance, and environmental training are incorporated into written procedures (i.e., work instructions) that describe how the work must be conducted. For maintenance and other ongoing projects, environmental review is conducted during planning and development of work instructions. For new activities at Yucca Mountain, a review also occurs as part of the land access review and control process (Section 3.1). Assessments (Section 3.9) and surveillances (Section 3.10) are conducted to ensure that work is performed within controls and to provide feedback for improvement.

3.1 LAND ACCESS REVIEW AND CONTROL

All new YMP activities and all ongoing activities that are substantially modified or require access to additional land must undergo a review before implementation. This process is initiated when principal investigators or responsible managers submit a land access request. The request is evaluated to determine whether the activity 1) is covered under existing ROWRs; 2) will result in land use conflicts; 3) will be in compliance with applicable federal, state, and local environmental laws and regulations (YMP 2001a, Section 7); 4) will require any new regulated, hazardous materials; and 5) will require additional environmental permits or modifications to existing permits. If new permits are required, they are applied for at this time. Reviews or preactivity surveys for biological and cultural resources (Sections 3.2 and 3.4) are conducted to identify potential impacts to those resources and prepare for future reclamation. Surveys for radiological hazards and residual radiological contamination also are conducted for activities planned on the Nevada Test Site.

If the activity can be conducted in compliance with environmental regulations and is acceptable to the ORD, a land access approval letter is issued. The letter contains permit requirements and other stipulations that must be incorporated into planning and implementation procedures as part of the YMP ISMS.

Clearance surveys for tortoises are conducted before the start of any ground-breaking activity that requires the removal of vegetation (Section 3.2). If available, topsoil is then removed and stored onsite or at one of the Project's existing topsoil stockpiles. During activities, surveillances are conducted to evaluate compliance with environmental stipulations (Section 3.10). After activities are completed, the amount of land disturbed is measured to track compliance with the biological opinion for the YMP (Buchanan 1997). If the site is no longer to be used, a reclamation plan is developed (Section 3.3).

During 2002, the ORD received nine requests for land access. Complete or partial approval was granted for all of the activities, which included six scientific studies, two construction projects, and one plan for reclaiming disturbed sites. All nine of the approved activities occurred on areas covered by existing ROWRs. Six of the activities required biological or archeological reviews or surveys, and four of the six required reclamation inventories. The remaining three activities occurred within existing disturbed areas and did not require reviews or surveys. Permit consultation with the Nevada Division of Health was required for the two construction requests involving the public water system at Yucca Mountain.

A total of 0.16 hectares (0.4 acres) of land was cleared of vegetation or soil in 2002. The amount of land disturbed by the Project since 1991 is 319 acres. This is 95 acres less than the total of 414 acres stipulated in the biological opinion for the YMP (Buchanan 1997). Of the 319 acres disturbed since 1991, 271 acres were disturbed before 1996. The amount of land disturbed per year generally has decreased over the past few years, with 12.4, 5.9, 2.0, 0.0, and 0.4 acres disturbed from 1998 through 2002, respectively.

3.2 BIOLOGICAL SURVEYS

Biological surveys are conducted to comply with the Endangered Species Act of 1973; the Migratory Bird Treaty Act of 1918, as amended; Section 404 of the Clean Water Act of 1977 and to develop methods for minimizing the impacts of YMP activities on plants and animals.

The biological opinion for the YMP (Buchanan 1997) requires preactivity surveys for desert tortoises prior to clearing vegetation. During those surveys, biologists evaluate potential impacts to tortoises from the proposed activity and, if necessary, identify ways to modify the activity to avoid harming tortoises and their burrows. Project biologists also evaluate potential impacts to migratory birds and other plant and animal species classified as sensitive by the BLM (or other involved land management agencies). In addition, biologists determine whether activities will need a permit to place dredged or fill material into waters of the United States. The biological opinion also requires clearance surveys to move tortoises or tortoise nests if they are in danger. Those surveys must be conducted before ground-disturbing activities, off-road driving, or trench filling can commence.

Preactivity and clearance surveys were conducted for five activities in 2002. Approximately 3.1 acres were surveyed. No desert tortoises were found, and no potential impacts to migratory birds were identified during the surveys. None of these or other activities conducted at Yucca Mountain during 2002 required placement of fill material into waters of the United States.

3.3 HABITAT RECLAMATION

Habitat is reclaimed for a variety of reasons:

- Comply with the terms and conditions of the biological opinion for site characterization (Buchanan 1997)
- Meet requirements in the Project's ROWRs (e.g., BLM 1988, 1989)
- Implement requirements in the Project's air quality operating permit (Elges 2001)

- Reduce the spread of exotic plant species as required by Executive Order 13112
- Implement commitments in the environmental assessment for site characterization (DOE 1986, Sections 4.1.1.4 and 4.1.2.6)
- Minimize impacts of site characterization, as required by Section 113 of the NWPA.

Reclamation is conducted in accordance with the updated *Reclamation Implementation Plan* (YMP 2001b). The long-term goal of the reclamation program is to reestablish processes on disturbed sites that will eventually lead to self-sustaining plant communities. Planning inventories, reclamation surveys, implementation, monitoring, remediation, and site-release evaluations are conducted to accomplish this goal. The planning process includes pre- and post-disturbance surveys and evaluations of past reclamation trials at Yucca Mountain. This information is used to identify appropriate implementation techniques for establishing structural and physical components, controlling soil erosion, and facilitating establishment of native vegetation. After implementation, monitoring is conducted to evaluate plant growth, identify remediation needs, and make final determinations regarding reclamation success so that sites can be released from further DOE input.

3.3.1. Reclamation Inventories

Reclamation inventories are conducted to identify methods for reducing the impact of construction activities and to assess site conditions and resources for final reclamation. Vegetation associations, plant species and their abundance, and the presence of exotic species are measured during these inventories. Stipulations may be developed for depth and location of topsoil stockpiles, chemical or vegetative stabilization of stockpiles, plant salvage, and practices to reduce wind or water erosion. Stipulations from the inventories are incorporated into approval letters for land access.

During 2002, reclamation inventories were conducted prior to pad preparation on the pre-cast yard for a million-gallon water storage tank, pad preparation for a booster water tank, and removal of several large rocks for scientific testing. Topsoil was stockpiled at the pre-cast yard and the booster tank pad. No topsoil was removed from the large blocks disturbance.

3.3.2. Reclamation Surveys

Reclamation surveys are conducted to assess reclamation requirements at disturbed areas no longer needed for the YMP. Survey information is gathered on slope, aspect, disturbance area, disturbance severity, site preparation needs for revegetation, and intensity of reclamation required. Based on this information, a final reclamation plan is written, which describes the actions needed for site preparation and reclamation. Site decommissioning is completed before reclamation, including removing waste and aboveground man-made structures, filling trenches, and closing and sealing boreholes.

In 2002, two sites were surveyed and plans were completed for final reclamation of a small area near the Subdock and remediation of an access road.

3.3.3 Reclamation Implementation

Reclamation is considered short-term when topsoil that is removed from disturbed sites is stockpiled for less than 1 year, and trenches or pits are backfilled outside of the usual planting season (October through December). Chemical stabilization of surface soil is commonly used in these circumstances. The topsoil stockpiles at the Pre-Cast Yard and the booster tanks were stabilized in 2002.

Final reclamation is implemented on long-term topsoil stockpiles and on sites that are no longer needed for the YMP and have been decommissioned. Final reclamation includes spreading and contouring topsoil, creating erosion-control structures, ripping, seeding, spreading and anchoring mulch, and fencing to exclude grazers.

Final reclamation was completed at 26 sites in 2002. These included 21 borehole pads, the Exile Hill water line, and three analog seismic sites. One scraped area was partially reclaimed. These sites totaled 7.4 acres. Sites were seeded in January or October - December with a mixture of native plant species. After seeding, all sites were mulched with straw, which was anchored to the soil with a chemical tackifier (a binding agent mixed with wood fiber and water used to hold seed and straw in place). Two of the reclaimed analog sites are near Ely, NV and the third analog site is north of Death Valley National Park in the Piper Mountain Wilderness area. All analog seismic sites were on BLM land for which the DOE has ROWRs, 17 seismic-borehole sites are on the Nevada Test and Training Range for which the DOE has ROWRs, and the remaining sites reclaimed in 2002 are on the Nevada Test Site. To date, final reclamation has been implemented on 241 former YMP disturbances totaling 87.2 acres.

3.3.4 Reclamation Monitoring and Remediation

To evaluate reclamation progress, sites are monitored periodically. If progress is not satisfactory, remediation is conducted (e.g., re-seeding, transplanting, erosion control efforts). During the summer of 2002, 129 reclaimed sites were monitored, including soil pits, trenches, boreholes, and access roads. Thirty-two percent of the sites were in good condition, 44 percent were in fair condition, 13 percent were in failing condition, and 11 percent were not assigned a rating because plant density was too low. Germination on unrated sites was probably poor because of dry soil conditions; germination is expected when soil conditions become more favorable. Sites in failing condition were generally those that had been reclaimed in 2000 or 2001, and germination had not yet occurred.

During 2002, 390 plants of 11 species were transplanted onto 9 sites to increase plant density, cover, and diversity. Transplanted species included *Acamptopappus shockleyi*, *Achnatherum speciosa*, *Ambrosia dumosa*, *Coleogyne ramosissima*, *Encelia virginensis*, *Ephedra nevadensis*, *Grayia spinosa*, *Menodora spinescens*, *Larrea tridentata*, *Lycium andersonii*, and, *Salazaria mexicana*. These species were selected because they did not establish very well from seed or seed was not available commercially.

Remediation was conducted on an access road in Crater Flat. The road was reclaimed in the fall of 1999 but was in poor condition because of heavy compaction along the tire tracks. This

access road was re-ripped along the tire tracks, re-seeded, harrowed to cover the seed, and mulched with a straw blanket. Approximately 2.2 acres were remediated.

Vegetation cover and soil erosion were monitored on 39 topsoil stockpiles. No action was required to maintain these stockpiles. Soil from these stockpiles will be respread over sites during final reclamation.

Reclamation success standards used to assess the condition of vegetation on reclaimed sites and to determine when sites can be released from further monitoring are set forth in the *Reclamation Implementation Plan* (YMP 2001b, Section 6.1). These standards state that reclamation can be considered successful, and sites can be released from monitoring, if cover, density, and species richness of native perennial vegetation are equal to, or exceed, 60 percent of the value of the same parameters in undisturbed reference areas. During 2002, three large sites (>0.25 acres) totaling 1.15 acres and 13 small sites (<0.25 acres) totaling 1.88 acres met the success standards for release. Two reports (one for the small sites and one for the three large sites) summarizing the monitoring results were drafted in 2002. To date, 55 former disturbed sites totaling 14.45 acres have been successfully reclaimed and released from monitoring.

3.4 CULTURAL RESOURCES AND NATIVE AMERICAN INTERACTIONS

Surveys for archeological resources, educational initiatives, and interactions with Native Americans were conducted to comply with the *Programmatic Agreement Between the United States Department of Energy and the Advisory Council on Historic Preservation for the Nuclear Waste Deep Geologic Repository Program Yucca Mountain, Nevada* (DOE 1988) and to meet the requirements of the laws and regulations described in Section 2.6.

3.4.1 Survey, Data Recovery, and Research

The Programmatic Agreement requires the YMP to conduct preactivity surveys for cultural resources before sites are disturbed. It also requires that survey activities, findings, and related data-recovery efforts be reported to various state and federal agencies. In addition, the condition of known archaeological sites must be monitored periodically, and research must be conducted in accordance with the *Research Design and Data Recovery Plan for Yucca Mountain Project* (DOE 1990). Artifact inventories are submitted to the U.S. Department of the Interior in compliance with reporting requirements of the Native American Graves Protection and Repatriation Act. Artifacts are maintained in a storage facility in Las Vegas, Nevada, in accordance with 36 CFR Part 79 and stipulations of the Programmatic Agreement.

Six archaeological preactivity surveys were conducted during 2002 in areas proposed for site activities. Archaeological surveys were also conducted at three sites to be reclaimed. No new archaeological sites or isolated artifacts were identified during those surveys. Twelve survey and monitoring reports were submitted to the SHPO and Advisory Council on Historic Preservation. Two reconnaissance reports on cultural resources were submitted to the BLM. Conditions at 13 previously documented historical properties at Yucca Mountain were evaluated, and other than minor natural lateral movement of a few artifacts, no major disturbances were noted at these monitored sites. Reclamation of previously disturbed areas occurred at or nearby several archaeological sites during 2002.

No mitigative data-recovery plans were developed during 2002. One site, 26NY7869, was subject to subsurface testing and surface collection. This site is located near an active fillstand and has been disturbed by periodic grading of a road that bisects the site. Data recovery to evaluate its historical significance was conducted in consultation with the SHPO. A total of 904 artifacts were collected. Subsurface testing revealed no buried cultural deposits. This program of data recovery has effectively shown that no further information of significance exists at the site, beyond what information has already been collected. A technical report of these investigations is in preparation.

Expansion of a precast concrete facility led to the collection of 15 artifacts from site 26NY8677. This site is a small, surface lithic scatter that had been partially collected when the precast facility was installed at this location.

Several studies were conducted to answer research questions identified in the *Research Design and Data Recovery Plan for Yucca Mountain Project* (DOE 1990). Studies included the continued development of a chronology and settlement classification of surface archaeological sites, preparation of a summary report of investigations, and updating and quality-correcting databases.

3.4.2 Educational Initiatives

The Project has developed educational displays to inform YMP workers and the public about the YMP archaeological program and the kinds of historical properties at the site. These displays are located at the Yucca Mountain Science Centers in Las Vegas, Beatty, and Pahrump, and at the Exploratory Studies Facility at Yucca Mountain for use during public tours. Items displayed include maps of southern Nevada depicting areas historically occupied by various tribes; biographical sketches of local Native Americans; artifacts and written explanations of their manufacture; examples of basket weaving and animal traps; traditional stories about certain plants and animals; and descriptions of plants as religious objects and sources of food, clothing, and medicine. A portable display and slide show has been developed for other presentations.

A general overview of the archaeology of Yucca Mountain was released in 2002 (*Reading the Stones: The Archaeology of Yucca Mountain*; Hartwell and Valentine 2002). This nontechnical report is suitable for a general audience and describes, among other things, some of the most important findings of the Project's archaeology program.

3.4.3 Native American Interactions

The ORD continued consultations and interactions with involved Native American tribes in 2002, as directed by the laws and regulations summarized in Section 2.4. Currently, the YMP Native American Interaction Program involves 17 concerned tribes and organizations (comprised of Western Shoshone, Southern Paiute, and Owens Valley Paiute and Shoshone) located in Nevada, California, Utah, and Arizona.

During 2002, the new DOE tribal liaison worked to become familiar with the tribes associated with the YMP Native American Interaction Program. Informal visits to tribal locations were initiated to introduce the new liaison. The YMP also sponsored attendance of the DOE, contractors, and Native American representatives at various meetings and training sessions,

including a meeting of the DOE Tribal Affairs Point-of-Contact held in Denver, Colorado; the annual meeting of the National Congress of American Indians; and a meeting of the Transportation External Coordination Working Group in New Orleans, Louisiana, where issues associated with transportation of spent nuclear fuel and high-level radioactive waste were discussed. In addition, the DOE sponsored educational workshops, speaking engagements, and site tours at which the YMP Native American program was explained to the public.

In July 2002, a Western Shoshone tribal representative participated in a data recovery effort associated with the YMP Cultural Resources and Native American monitor program. As part of the program, Native American monitors accompany archaeological staff in the field to ensure that Native American sensitivities are considered during artifact collection. The data recovery efforts are described in Section 3.4.1.

The ORD has a standing offer to continue consultations required by the Native American Graves Protection and Repatriation Act with any tribe that was not able to participate during the 1998/1999 consultation process. To date, the DOE has not received any additional requests for consultation, or any formal requests for repatriation of artifacts that meet the criteria of the Native American Graves Protection and Repatriation Act.

3.5 AIR QUALITY

Ambient air-particulate matter has been sampled as part of the environmental monitoring program since 1989, using standard regulatory agency methods. From 1991 to 1999, the State of Nevada air quality operating permit for the YMP stipulated that DOE must measure PM_{10} , inhalable particulate matter 10 micrometers or less in diameter—at Yucca Mountain. Monitoring has continued since then to demonstrate continued compliance with federal (40 CFR Part 50) and Nevada (NAC 445B) ambient air quality standards.

Air quality was monitored at three sites during 2002, although monitoring at Site 5 was discontinued late in April 2002. Site 1 is in Midway Valley near the Exploratory Studies Facility (Figure 3); it represents conditions near most of the surface-disturbing activity at Yucca Mountain. Site 5 is in Jackass Flats along Fortymile Wash near Well J-12; it was selected to measure remote, background concentrations. Site 9 is at Gate 510 on the Nevada Test Site near Amargosa Valley, about 13 mile south of the Exploratory Studies Facility. This site, located near the community of Amargosa Valley, is used as an indicator of “ambient” air quality. Two PM_{10} samplers were operated simultaneously at Site 1 to assess the precision of measurements for QA requirements. PM_{10} has been sampled at Sites 1 and 5 since April 1989, and at Site 9 since October 1992. The reduction in monitoring by discontinuing sampling at Site 5 was driven by cost-saving efforts. The PM_{10} air quality conditions had been adequately established at Site 5.

Twenty-four-hour sampling was scheduled every sixth day during 2002, as in previous years. Sites 1 and 9 had valid sampling results for 59 and 58 days, respectively, out of 61 possible scheduled days. Seventeen samples were taken at Site 5 until this monitoring was discontinued in late April 2002. The sampling and analysis program was performed in accordance with EPA and Nevada standards, monitoring requirements, and guidance.

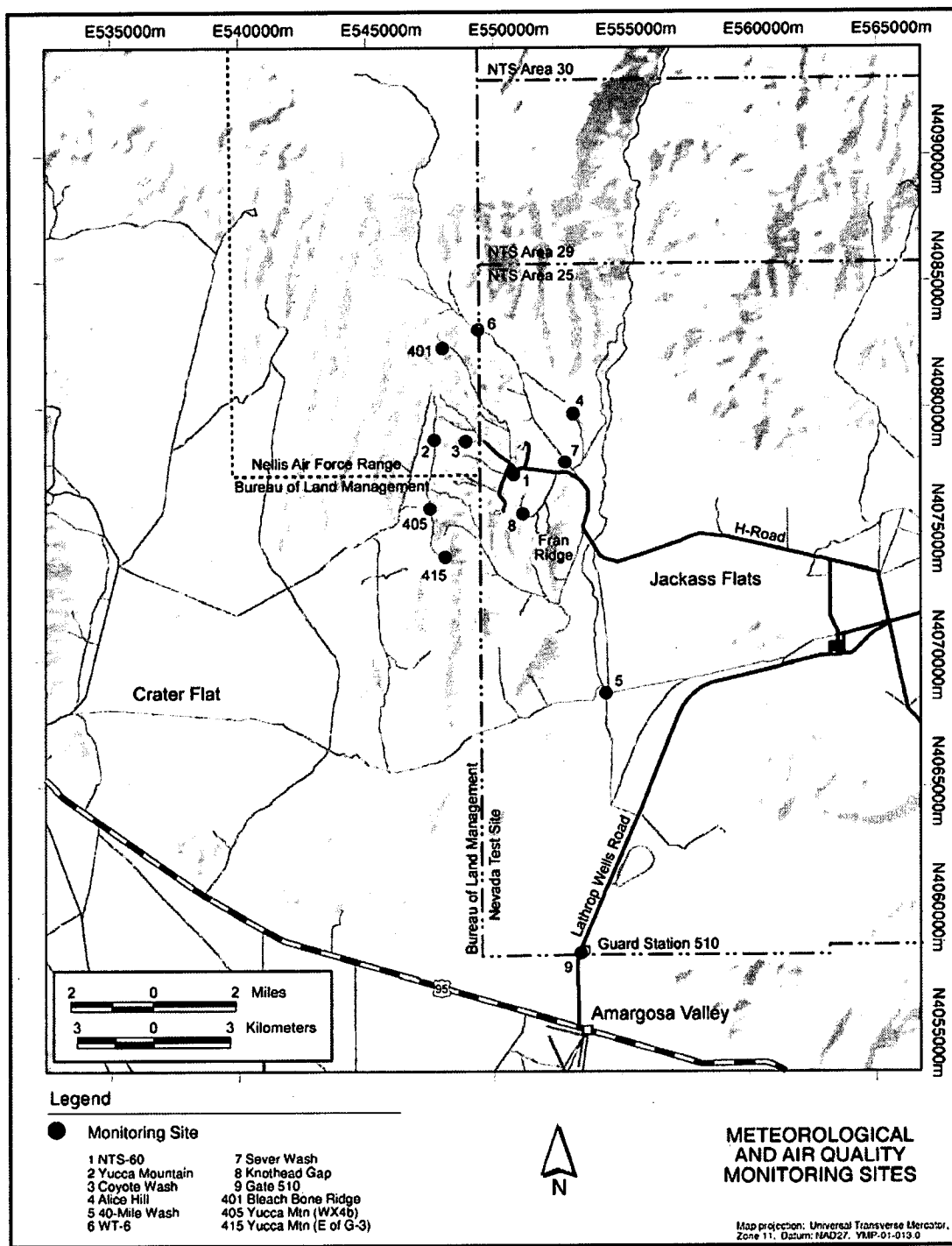
Concentrations of airborne particulate matter were generally low in 2002, though a few days were affected by wildfires in southern Nevada. Summaries of the last 5 years of sampling are shown in Table 2. The highest 24-hour concentrations of PM₁₀ in 2002 at Sites 1 and 9 were 52 and 43 micrograms per standard cubic meter ($\mu\text{g}/\text{m}^3$), respectively. These samples were taken on July 13, when wildfires were occurring in the region. The highest value ever recorded in this network was $67 \mu\text{g}/\text{m}^3$; this was measured in 1995. All measurements in 2002 were much lower than the maximum allowable 24-hour concentration of $150 \mu\text{g}/\text{m}^3$. Arithmetic mean concentrations were $10 \mu\text{g}/\text{m}^3$, which are about 80 percent lower than the maximum allowable annual arithmetic mean of $50 \mu\text{g}/\text{m}^3$. These annual average concentrations are similar to those from previous years (Table 2).

3.6 METEOROLOGICAL MONITORING

Local meteorology has been monitored at Yucca Mountain since 1986 to characterize environmental conditions, study mechanisms of airborne transport of contaminated materials, and provide input to the design of surface facilities.

Meteorological parameters, including wind, temperature, humidity, precipitation, barometric pressure, and atmospheric stability, were measured at four sites during 2002 (Sites 1, 2, 4, and 9) (Figure 3). Precipitation, air temperature, and humidity were measured at five other sites (Sites 3, 5, 6, 7, 8) around Midway Valley and in Jackass Flats. Rain and snow also were measured at three all-season precipitation gauges (Sites 401, 405, and 415) on the crest of Yucca Mountain.

Precipitation during 2002 was only about 20 percent of the recent 7-year average, and was about 10 percent of the very wet year of 1998 (Table 3). This was by far the driest year during this period. Precipitation varied considerably among sites, with Site 9 in Amargosa Valley having the least amount each year, and Sites 3 and 6 on the east and north sides of Yucca Mountain generally having the most. The very low totals from this year differed slightly, with Site 1 showing the greatest amount in the network.



PGM-MGR-EC-000002-Fig-3.DOC/5-20-02

Figure 3. Air Quality and Meteorology-Monitoring Sites

Table 2. Summary of Ambient Particulate Matter PM₁₀ Sampling, 1998-2002 (µg/m³)

Site	1998	1999	2000	2001	2002
Highest 24-hour average					
1	30	18	38	23	52
5	26	24	45	27	13 (part year)
9	22	18	36	22	34
Second-highest 24-hour average					
1	17	34	34	19	37
5	18	21	39	25	13 (part year)
9	20	17	33	19	39
Arithmetic mean of 24-hour average					
1	8	8	11	8	10
5	7	8	12	10	not applicable
9	6	6	11	9	10

Table 3. Annual Precipitation at Meteorological Sites, 1998-2002

Site	Elevation (feet)	Precipitation (inches)					Average
		1998	1999	2000	2001	2002	
1	3,750	14.43	7.22	9.69	7.07	1.56	7.34
2	4,849	13.76	5.72	8.73	7.82	1.26	6.74
3	4,196	16.32	7.15	10.26	8.63	1.33	7.82
4	4,049	13.58	8.18	8.61	7.31	1.31	7.09
5	3,127	11.69	3.40	5.36	5.03	1.32	5.14
6	4,315	17.40	5.29	10.70	8.83	1.16	7.91
7	3,547	13.95	7.92	9.91	6.74	1.26	7.26
8	3,711	13.42	6.31	9.71	6.87	1.06	6.91
9	2,749	8.85	2.59	4.09	4.51	0.74	3.95
401	5,125		4.81	9.65	8.10	1.20	5.91
405	4,882		6.32	8.31	5.96	0.99	5.40
415	4,725		5.64	7.36	6.26	1.11	5.09

3.7 WATER MONITORING

Groundwater levels and spring flows in the Yucca Mountain region have been monitored for the YMP since 1992 to detect and document background fluctuations in regional groundwater levels, spring flows, and withdrawals; and to identify potential effects of groundwater withdrawals from YMP-permitted wells on regional groundwater levels and spring flows. Because the YMP does not release effluents into groundwater or otherwise affect the quality of that water, water quality is monitored only to meet permit requirements described in Section 2.6.

During 2002, groundwater levels and spring flows were monitored at 34 wells, one flowing well, and five springs (Figure 4). Water levels were measured monthly at wells, and discharge rates at springs were measured quarterly. Annual estimates of groundwater withdrawals were obtained primarily from the U.S. Geological Survey and the Nevada Division of Water Resources.

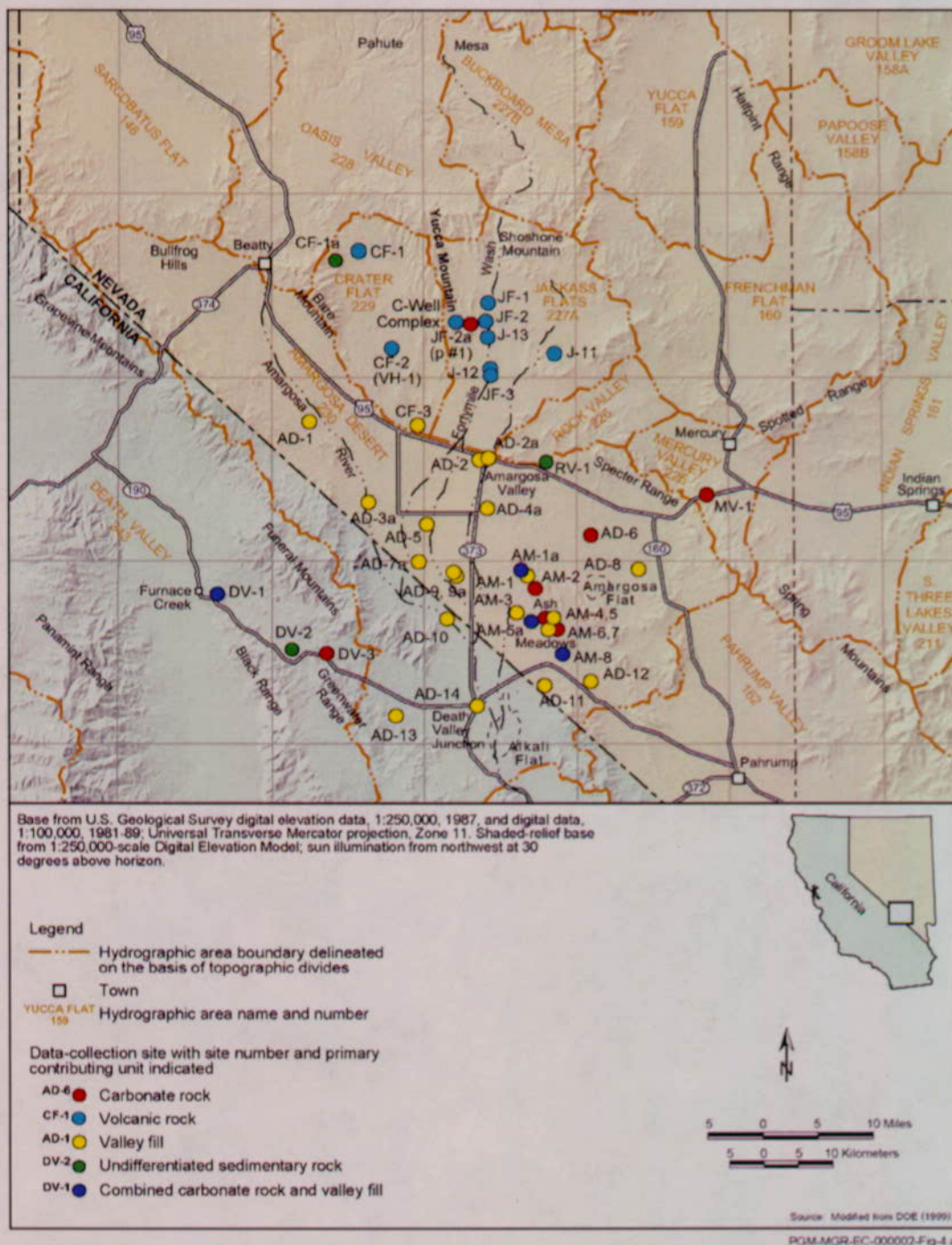


Figure 4. Groundwater Monitoring Wells and Springs

The potential effects of water withdrawals from YMP wells are assessed by comparing current data to historical or baseline water levels and spring flows. Additionally, measurements of spring flow provide data on the status of water availability in environmentally sensitive areas of Ash Meadows, Devils Hole, and Death Valley. Results of this monitoring program through 2000 are described in Fenelon and Moreo (2002). This report analyzed YMP water monitoring data and other related regional data for trends or fluctuations in water levels or discharge. The analysis showed that between 1992 and 2000, water levels in Jackass Flats, where YMP withdraws the majority of its water, either had slight upward trends or were unchanged. Changes in groundwater levels and spring flows elsewhere in the region were attributed to factors such as climatic change, local and regional groundwater withdrawals, and earthquakes (Fenelon and Moreo 2002). YMP groundwater withdrawals had no measurable effect on regional groundwater levels or spring flows. More recent groundwater-level data for wells in Jackass Flats are compared to established baseline data in Table 4.

Well JF-3 was installed in 1992 and routinely measured since then to monitor the effects of groundwater withdrawals from Wells J-12 and J-13 (Figure 4). The depth to water in this and most other YMP monitoring and water supply wells in Basin 227A (Wells J-11, J-12, J-13, JF-1, and JF-2) was almost identical to baseline water levels (Table 4). The water level in monitoring well JF-2a was nearly 2.2 feet higher than the pre-1991 baseline water level (Table 4). Well JF-2a was completed in the confined carbonate aquifer (Section 1.1.3). This rise in the water level has been attributed to upward flow from the carbonate aquifer (Luckey et al. 1996, pp. 40 and 41).

Table 4. Water Level Altitudes in Wells in Jackass Flats (in feet)

Well	n	2002 ^a			Previous Years – Median Value				
		Min	Max	Median	2001 ^b	2000 ^c	1999 ^d	1998 ^d	Baseline ^d
JF-1	17	2392.8	2393.4	2393.1	2393.1	2392.8	2392.7	2392.5	2392.5
JF-2	5	2391.2	2392.7	2392.1	2392.8	2392.7	2392.5	2392.1	2392.1
JF-2a	16	2470.2	2471.2	2470.8	2471.0	2470.6	2470.2	2470.0	2468.6
J-13	17	2385.4	2390.7	2389.7	2390.5	2390.2	2390.0	2389.8	2390.0
J-11	16	2402.1	2402.6	2402.3	2402.7	2402.4	2402.4	2402.6	2402.2
J-12	16	2388.4	2388.8	2388.6	2388.5	2388.4	2388.3	2388.0	2388.3
JF-3	13	2388.4	2388.7	2388.5	2388.5	2388.4	2388.2	2388.0	2388.3

NOTES: ^a Source: Wade 2002d, 2002e, 2002f, 2003e.

^b Source: Wade 2001a, 2001b, 2001c, 2002g.

^c Source: YMP 2001c, Table 4.

^d Source: Locke 2001. Table 10 (baseline years are 1985-1991 for JF-2, JF-2, and JF-2a; 1989-1991 for J-13; 1990-1991 for J-1 and J-12; and 1992-1993 for J-3).

3.8 HAZARDOUS MATERIALS MANAGEMENT AND POLLUTION PREVENTION

3.8.1 Hazardous Materials

To minimize the potential hazards of chemicals to personnel and the environment, a review of all proposed uses of hazardous materials is required before purchase or use on the Project. To initiate this review, a request for authorization must be submitted before any hazardous material

is purchased. The request, Material Safety Data Sheets, and chemical databases are then reviewed to identify requirements, potential environmental hazards, and health and safety risks. When reasonable, suitable substitutes are discussed with the requester. If no substitute is available, authorization to use the material may be denied, or requirements for the use of the material to minimize risks are developed (e.g., storage methods, personal protective equipment and handling requirements, training, spill prevention methods, and waste disposal).

These requirements are incorporated into work instructions governing use of the materials, as part of the Project's ISMS program. Surveillances (Section 3.10) are conducted periodically to ensure that these procedures are followed.

All chemicals stored at Yucca Mountain and other sites operated by the Project are inventoried and tracked. This information is used to comply with the requirements of EPCRA and Nevada regulations (NAC 477) (Section 2.7.3), including compilation of a list of specified hazardous materials (Table 5).

3.8.2 Waste Management

Hazardous and Universal Wastes—To meet the requirements of RCRA (Section 2.7.4), all hazardous and universal wastes are accumulated, packaged, transported, and disposed of offsite in accordance with federal and state requirements (Section 2.7.4). These wastes were generated from sources such as laboratory studies, routine cleaning and maintenance, construction, and excess supplies from discontinued equipment. There were no offsite shipments of these wastes during 2002.

Nonhazardous Waste—During 2002, refuse, industrial, salvageable, and other nonhazardous waste were recycled, reused, or disposed of (Table 6) in accordance with federal and state requirements (Section 2.7.4). As part of the YMP pollution prevention program (Section 3.8.3), efforts were made to recycle, rather than dispose of, waste whenever possible.

Table 5. Maximum Quantity of Hazardous Materials Stored at Yucca Mountain During 2002

Category ^a	Material	EHS ^b	Max Qty ^c
C.7	Acetylene		3,850 ft ³
C.7	Carbon Monoxide		108 ft ³
C.7	HFC-134A (1,1,1,2-Tetrafluoroethane)		30 lbs
C.7	Hydrogen Sulfide in Nitrogen		6 ft ³
C.7	Nitrogen		2,000 ft ³
C.7	Nitrogen Dioxide in Nitrogen	X	15 ft ³
C.7	R-12 (Dichlorodifluoromethane)		145 lbs
C.7	Oxygen		6,802 ft ³
C.7	Hydrogen		400 ft ³
F.3	Acetone		109 lbs
F.3	Cooler Coating (petroleum distillate)		8 gal
F.3	Diesel Fuel		57,600 lbs
F.3	DP-Lubricant Blue (Ethanol)		40 lbs
F.3	Exterior Oil Primer #2110 (Stoddard Solvent)		1,430 lbs
F.3	Exterior Oil Primer #2516 (Stoddard Solvent)		1,138 lbs

Table 5. Maximum Quantity of Hazardous Materials Stored at Yucca Mountain During 2002
(Continued)

Category ^a	Material	EHS ^b	Max Qty ^c
F.3	Gasoline		63,590 lbs
F.3	Isopropyl Alcohol		101 lbs
F.3	Kerosene		719 lbs
F.3	Lacquer Thinner (Bortz 666B)		144 lbs
F.3	Mineral Spirits		132 lbs
F.3	Paint (Devguard)		62 gal
F.3	PF Degreaser (Degreaser Solvent)		20 lbs
F.3	Primer (Devguard)		60 gal
F.3	PVC Cement		205 lbs
F.3	PVC Primer		124 lbs
F.3	QB-300 Adhesive (Treated Heavy Naphtha)		49 lbs
H.1	Antifreeze		4,456 lbs
H.1	Waste Antifreeze		110 gal
H.1	Cement		107,600 lbs
H.1	Greases, Lubricants, Oils		46,195 lbs
H.1	Hydrochloric Acid		208 lbs
H.1	Lithium Bromide		52,391 lbs
H.1	Nitric Acid	X	3 lbs
H.1	Sodium Hydroxide		800 lbs
H.1	Sulfuric Acid	X	6,582 lbs
H.1	Terraset Part A (Sodium Silicate)		6,009 lbs
H.1	Terraset Part B (Glycerol Esters)		4,607 lbs
H.1	Waste Oil		12,257 lbs
H.1	Americium-241 (sealed source)		9.86E+02 mCi
H.1	Americium-Beryllium-241 (sealed source)		4.85E+01 mCi
H.1	Americium-Beryllium-241 (sealed source)		4.87E+01 mCi
H.1	Americium-Beryllium-241 (sealed source)		9.53E+02 mCi
H.1	Americium-Beryllium-241 (sealed source)		4.85E+01 mCi
H.1	Americium-Beryllium-241 (sealed source)		4.89E+03 mCi
H.1	Cesium-137 (sealed source)		1.89E+02 mCi
H.1	Cesium-137 (sealed source)		2.60E+01 mCi
H.1	Cesium-137 (sealed source)		3.29E+01 mCi
H.1	Nickel-63 (sealed source)		4.82 E+00 mCi
H.1	Nickel-63 (sealed source)		4.82E+00 mCi
L.1	Propane		17,275 lbs

NOTES: mCi = millicurie

^a C.7 = Compressed gases at normal temperatures and pressures, F.3 = Flammable or combustible liquids, H.1 = Other hazardous materials, L.1 = Liquefied Petroleum Gas.

^b EHS = Extremely Hazardous Substance, per EPCRA Section 302.

^c Values are presented in the unit of measure reported to regulatory agencies.

Table 6. Types and Amounts of Wastes Recycled, Reused, or Disposed of During 2002

Material	Method	Amount ^a
Debris (hydrocarbon-contaminated)	Disposed	22 tons
Industrial solid waste	Disposed	15 tons
Refuse (Las Vegas)	Disposed	731 tons
Refuse (Site)	Disposed	10.4 tons
Tires (non-recyclable)	Disposed	1 ton
Aluminum cans	Recycled	1,323 lbs
Antifreeze	Recycled	247.5 gal
Cardboard	Recycled	2,518 lbs
Copy machine and printer toner cartridges	Recycled	1,568
Ferrous and non-ferrous metals (does not include aluminum cans)	Recycled	5.4 tons
Lead-acid batteries	Recycled	6.5 tons
Paper	Recycled	276 tons
Soil (hydrocarbon-contaminated)	Recycled	22 yd ³
Tires (truck and heavy-equipment)	Recycled	9.5 tons
Used oil from equipment maintenance	Recycled	1,967.5 gal
Used oil from oil/water separator	Recycled	23 gal
Used oil total	Recycled	1,990.5 gal
Water (oil/water separator)	Recycled	10,900 gal
Water (mine waste water)	Recycled	40,830 gal
Used notebook binders	Reused	3,478
Used computers	Reused	331

NOTE: ^a Values are presented in the unit of measure reported to regulatory agencies.

3.8.3 Pollution Prevention

The pollution prevention program for the YMP is described in the *Waste Minimization and Pollution Prevention Awareness Plan* (YMP 2001d). The plan was reviewed in 2002 in accordance with DOE Order 5400.1. The plan establishes a pollution prevention committee, reporting and record-keeping requirements, and requirements for pollution prevention opportunity assessments.

Pollution Prevention Committee—Four quarterly Pollution Prevention Committee meetings were held during 2002. Representatives from organizations and departments across the YMP attended the meetings to discuss implementation of pollution prevention measures, including sustainable design, affirmative purchasing, energy efficiency, water conservation, waste management, purchase approval and tracking of hazardous materials and wastes, and waste minimization. These meetings provide an opportunity to talk about attainable action items from established pollution prevention goals. Committee members bring topics and issues back to their departments for further input, action, or to increase employee awareness.

Reporting and Record-Keeping Requirements—Executive Order 13101 (Section 2.1.5) requires that each federal agency purchase, to the greatest extent practicable, EPA-designated products containing recycled materials (40 CFR Part 247). YMP has an affirmative procurement program that supports the federal goal to purchase 100 percent of such items by 2005, except when the items are not readily available, not competitively priced, or do not meet performance

specifications. During fiscal year 2002, the YMP affirmative procurement program attained approximately 90 percent compliance with this goal. An affirmative procurement report summarizing this information was prepared as required by Executive Order 13101 (Sorensen 2002b).

An Annual Report on Waste Generation and Pollution Prevention Progress (Wade 2002h) summarized quantities of waste generated and recycled, and waste minimization activities and accomplishments during fiscal year 2002. The waste generation and recycling information is provided in Table 6.

Pollution Prevention Opportunity Assessments—Two pollution prevention opportunity assessments that were initiated in 2001 were completed in 2002 (Sorensen 2002c). One assessed increased recycling opportunities at Yucca Mountain for aluminum cans, paper, cardboard, and scrap metals. Methods were implemented to increase recycling of paper and aluminum cans. Cardboard recycling was identified as a new recycling opportunity. The second assessment reevaluated opportunities for recycling at Las Vegas office facilities. Paper and aluminum cans are collected for recycling in the Las Vegas office facilities, but because of minimal local and state recycling initiatives, no additional recycling opportunities were identified.

Employee Awareness Initiatives—In addition to the efforts of the Pollution Prevention Committee, numerous initiatives were undertaken in 2002 to raise employee awareness and increase participation in pollution prevention efforts.

- A pollution prevention website was developed and deployed.
- Pollution prevention articles were published on BSC and ORD websites and posted in community areas throughout the YMP.
- Key members of the Pollution Prevention Committee attended staff meetings to discuss pollution prevention initiatives and their implementation.
- An interactive pollution prevention booth was developed for a Zero Accident Philosophy Day event.
- An employee recognition/award program for pollution prevention achievements was further refined by recognizing small efforts through penny/dollar and two-cents/two dollar awards and larger contributions through “on the spot” and manager-signed certificate of achievement awards.
- Considerable effort was made in 2002 to further reduce and reuse paper, while continuing the active YMP paper-recycling program. Employees were encouraged to use scratch pads made from paper to be recycled by BSC’s Reprographics Department. The use of handouts at meetings was discouraged. A “paper use reduction challenge” was integrated into a Zero Accident Philosophy campaign to increase employee overall awareness and participation. Employees were encouraged to reuse single-sided printed paper and to print document drafts on less expensive personal desktop printers. The YMP continued to reduce the amount of paper used by implementing electronic

communications. This included electronic distribution of correspondence, document review/comment sheets, surveys/questionnaires, and certificates of training completion.

Affirmative Procurement Program—A mandatory ES&H review of each purchase requisition was initiated in mid 2002. During the review, requested items were evaluated for compliance with Executive Order 13101 requirements, hazardous materials purchasing requirements, and for safety and health concerns.

Sustainable Design—Sustainable Design is incorporated into the repository design process by developing design criteria, conducting pollution prevention design assessments, and providing training to the design staff.

DOE Secretarial Pollution Prevention and Energy Efficiency Goals—The YMP initiated or continued numerous activities in 2002 to reduce pollution, increase energy efficiency, and phase out ozone-depleting substances, as directed by the DOE Pollution Prevention and Energy Efficiency Leadership Goals for Fiscal Year 2000 and Beyond (Richardson 1999).

The hazardous material approval process (Section 3.8.1) is followed to reduce the use and generation of hazardous and toxic substances. The YMP did not manufacture, process, or otherwise use any chemical regulated under Section 313 of EPCRA in excess of threshold quantities during 2002. From 2001 to 2002, a reduction of 484 pounds of hazardous waste generated by the Project. The total quantity of hazardous waste collected for 2002 was 201 pounds. A universal waste (mostly fluorescent lamps and nickel-cadmium batteries) totaling 638 pounds was also collected. As part of the Project's pollution prevention program, numerous materials were recycled or reused.

Because of improvements in the affirmative procurement program, purchases of items manufactured with recycled content increased to 90 percent in fiscal year 2002 compared to about 75 percent in fiscal year 2001.

Energy efficiency upgrades, such as lighting sensors and closer monitoring of building thermostats, continued to function properly in 2002. An evaluation of energy savings from these upgrades is planned, as is the development of an energy usage baseline for office facilities in Las Vegas.

All purchase requests for ozone-depleting substances and those generating greenhouse gases were reviewed in 2002. New purchase requests for Class I ozone-depleting substances were rejected. The use and storage of Class I ozone-depleting substances was monitored during 2002.

Many of the YMP fleet vehicles use compressed natural gas, which is an alternative fuel. A compressed-natural-gas refueling station was installed in 2002 near YMP facilities in Las Vegas to service alternative-fuel vehicles. Use of this alternative fuel continues ORD's efforts to increase the fuel efficiency of its fleet.

3.9 ES&H ASSESSMENTS

The ES&H assessment program is conducted to fulfill DOE Policy 450.5 (Section 2.8) and requirements outlined in the *Environmental Management Plan* (YMP 2000) and the *Yucca*

Mountain Site Characterization Project Requirements Document (YMP 2001a, Section 7). The assessments provide programmatic oversight of YMP activities to ensure full compliance with regulations and excellence in the ES&H and ISMS programs. This is accomplished through independent evaluations of YMP ES&H activities and programs for compliance with applicable federal and state laws; DOE policy; permit stipulations; and YMP plans, policies, and procedures. The assessment process, which includes verification, validation, and closure of corrective actions, enhances the effectiveness and implementation of ES&H roles and responsibilities among YMP organizations.

Assessment topics are selected based on requirements for periodic program reviews, the potential for noncompliance conditions, management requests, or the need to evaluate newly implemented or changed programs. Assessments are conducted through document reviews, observation of work practices, and interviews to evaluate compliance with the governing regulatory and procedural requirements. Assessment results, including noncompliance, opportunity-for-improvement findings, and the responsible manager's corrective action plan are documented in an assessment report. Findings and corrective actions are entered into the Condition/Issue Identification and Reporting/Resolution System for tracking. Assessment items are closed when completed corrective actions have been verified by the lead assessor and validated by the ES&H assessment manager for opportunity-for-improvement findings, or by the ORD Office of Facility Operations for noncompliance findings.

During 2002, nine assessments were conducted to evaluate compliance with ES&H requirements relative to accident investigations, personal protective equipment, hazardous material approval and tracking, silica protection, computer-based training, packaging and transportation safety, ISM implementation, ergonomics program, and the 1988 Price-Anderson Amendments Act (Table 7).

3.10 ENVIRONMENTAL SURVEILLANCE PROGRAM

Environmental surveillances are conducted to confirm that activities are planned, managed, and implemented in a manner that protects environmental quality, minimizes threats to the environment, and complies with programmatic requirements and permit stipulations. Surveillances may investigate, among other things, procedural requirements (e.g., DOE directives, YMP plans and procedures), permit conditions, land access stipulations, and environmental regulations. Most surveillances are planned in advance; however, surveillance reports and associated corrective actions also are written whenever an environmental compliance issue is noted or reported.

Table 7. 2002 Assessment Results

Assessment	Results
Accident Investigation (02-02)	This assessment evaluated the implementation of procedural requirements for selecting and training Readiness Team members and conducting interim investigations of Type A and B accidents. Assessment findings resulted in a redefinition of team-member roles and responsibilities, and processes were modified to be more commensurate with contractor interim-investigation requirements
Personal Protective Equipment (02-03)	This assessment evaluated nine elements of the BSC Personal Protective Equipment program and identified needed improvements in equipment selection, training on the use of the equipment, and dissemination of equipment requirements in Job Safety Analyses and Work Orders
Hazardous Material Approval and Tracking (02-04)	Processes and mechanisms for approving/tracking hazardous material procurements were examined. Process improvements resulting from this assessment included ES&H screening of all procurement requests, plans to expand database capabilities for tracking material inventories, and establishment of an excess materials turn-in program
Silica Protection Program (02-06)	Assessment of silica-protection processes resulted in program improvements that more effectively ensure that dust and silica hazards and controls are fully identified during work planning, more extensive area- and personnel-monitoring is conducted and documented, potentially harmful dust accumulations are collected and removed, and silica and asbestos training is more tailored to local conditions
ISMS Annual Review (02-07)	This annual review of ISMS implementation identified noteworthy practices in the areas of safety performance and work prioritization, and noted a number of opportunities for improvement in procedural and implementation issues relating to work planning and hazards analysis processes
ES&H Computer-based Training (02-08)	This comprehensive review of all ES&H-related computer-based training programs resulted in a more structured periodic review of these programs, the planned replacement of commercially-produced programs with more site-specific training, and enhanced means for obtaining student feedback
Packaging and Transportation Safety (02-10)	Evaluated U.S. Department of Transportation packaging and transportation-safety program requirements; corrective actions resulted in continued program improvements that more fully meet regulatory requirements
Ergonomics Program (03-01)	This assessment identified opportunities for improvement in the use and documentation of ergonomic information, and clarification of the Safety and Health Manager's role in the ergonomic program
Price-Anderson Amendments Act (03-02)	The newly implemented program for screening reported events and conditions for potential applicability to this Act was evaluated. Program enhancements were implemented to expand screening resources and improve staff notifications and Review Board coordination. An orientation program was also implemented to inform affected personnel of program objectives

Three hundred and fifty-two environmental surveillance reports were completed in 2002. Positive observations, noteworthy practices, or no environmental concerns were identified in 96 percent of the surveillances (337). This compares to 91 percent in 2000 and 94 percent in 2001. Of the 15 surveillances for which concerns were noted, 7 corrective actions were introduced for spills and waste management issues and 8 were implemented for noncompliance with procedures and plans. There were no permit violations or reportable spills in 2002.

Trends in corrective actions for permit compliance, spills and waste management, and procedural deficiencies are tracked as measures of environmental performance of the YMP. These trends are reported monthly. All trends were negative in 2002 (i.e., there was a decrease in the number of findings compared to 2001). This decrease in the number of surveillance reports requiring action indicates that changes in the work planning and implementation process in recent years have been successful. Closer attention to compliance with procedures and work instructions and

greater worker involvement in the planning and conduct of the work have helped reduce the need for corrective actions.

3.11 TRAINING

Worker training on environmental compliance, pollution prevention, and all other aspects of ISMSs is an important part of the YMP environmental program. All Project personnel working at Yucca Mountain are instructed on the environmental and safety requirements that must be followed for field activities. Additional job-specific training is offered commensurate with job responsibilities.

All new employees must take Employee ES&H Training. This four-hour course covers, among other things, Project environmental protection requirements, hazard communication, waste minimization, pollution prevention, and safety and health requirements. A computer-based annual refresher of these topics also is required of all employees.

All new employees who work unescorted at Yucca Mountain must take Site Access Training. This three-hour class describes the employees' responsibilities for land access, protecting biological and cultural resources, hazardous and nonhazardous waste management, and environmental permit compliance. Computer-based, annual refresher training is also required.

Environmental Compliance Awareness for Managers and Supervisors is required for all managers and supervisors. This computer-based training informs managers and supervisors of their responsibilities for maintaining environmental compliance and protecting the environment, and the consequences of not taking environmental concerns seriously. Managers are instructed to minimize environmental impacts; comply with environmental regulations; and mitigate impacts through prevention, corrective action, reclamation, and other measures.

Employees whose work involves the transportation of hazardous materials are required to attend a three-day training class on the basics of hazardous materials transportation and to attend additional job-specific classes. Personnel also are required to attend a three-day advanced class if their work involves the certification of shipping papers for hazardous waste or radioactive materials.

A class in Leak Detection and Mitigation is required for employees whose work involves control and reporting of hazardous material spills. This two-hour class covers oil and hazardous materials in work areas; spill and release scenarios; spill response stations, equipment and materials; and procedures for spill and release response, including health, safety containment, cleanup, notification, and reporting requirements.

4. QUALITY ASSURANCE

The quality of environmental data and results presented in this report were ensured through QA practices. Appropriate industry standards and accepted laboratory and field monitoring practices were used to establish QA practices. These practices are compliant with permit requirements applicable to collection and analysis of environmental data. The QA practices were applied to the appropriate aspects of monitoring, sampling, analysis, data reduction, and reporting operations to produce data of known quality. Some aspects of the environmental program described in this report [i.e., radiological monitoring program support; meteorological monitoring and data analysis; tracers, fluids, and material reporting for reclamation (BSC 2001a, 2001b, and 2001c)] also were subject to the requirements of the *Quality Assurance Requirements and Description* (DOE 2003).

The QA practices were implemented through the systematic application of QA policies, standardized procedures, and independent assessments. QA controls included the following:

- Personnel training was conducted and documented before work was initiated.
- Work instructions and procedures were developed and reviewed before they were approved for use.
- A verbatim compliance policy for work performance, in accordance with approved procedures, was mandated for all work.
- Standards traceable to the National Institute of Standards and Technology were used to calibrate and check measuring and test equipment.
- Equipment used for monitoring, sampling, analysis, and counting were regularly calibrated at prescribed intervals.
- Operational status and accuracy of equipment were independently and routinely checked by trained personnel.
- Discrepancies and nonconforming conditions, which may have affected data quality, were documented and evaluated in accordance with a structured and approved corrective action process.
- Technical data were reviewed before data reduction and analysis and reporting.
- Computer software used for data reduction and analysis were evaluated and controlled.
- Monitoring, sampling, analysis, and subsequent data reduction were periodically evaluated to verify effective implementation.
- Compliance with QA procedures for meteorological monitoring was verified by independent assessments.

4.1 SAMPLE CONTROL

All environmental samples were controlled in accordance with approved work instructions and procedures. These controlled procedures specified approved methods and processes for sample collection, sample handling, chain-of-custody control, and analysis and data reporting.

Technicians were trained to ensure that samples were properly labeled, stored, and protected against loss or contamination. Samples were uniquely identified by markings on either the sample or its packaging. Sample transactions were documented on either a "Chain-of-Custody" form for external transfers or a "Sample Transfer" form if transferred internally. Transfer recipients were required to verify that proper conditions and identification of samples were provided and maintained before accepting custody of the samples.

4.2 SAMPLE ANALYSIS

Analyses of samples were conducted in accordance with approved protocols, based on standard and approved methods. Personnel performing analyses and measurements were specifically trained for these work assignments before initiating work.

As prescribed by a scope of work, analysis programs selectively used sample blanks, spikes, and replicates to better determine accuracy and precision of methods and to eliminate bias. Subcontractors who measured or analyzed samples were required to establish an equivalent QA control system. Results of measurements and analyses were reviewed and approved by qualified personnel.

4.3 INSTRUMENT CONTROL

Instruments used to measure, monitor, test, or sample environmental conditions were procured, calibrated, controlled, and maintained in accordance with approved procedures. Equipment and calibration standards used to ensure instrumentation accuracy were traceable to the National Institute of Standards and Technology. Frequency of equipment calibration and maintenance were prescribed in approved procedures, based on manufacturers' recommendations.

Performance of all calibrated equipment was periodically checked to verify its adherence to operational specifications. Calibrated equipment was routinely checked by field technicians, and adjustments were made to optimize its performance. Out-of-tolerance conditions were documented, and resolution was determined by recalibration, rework, or replacement. Data affected by out-of-tolerance conditions were reported and identified as "indeterminate" until resolution of the condition had been evaluated to determine if the data could be validated.

4.4 DATA MANAGEMENT

To preserve data integrity, monitoring and sampling data were recorded and handled in accordance with approved procedures. The efficiency of data reduction software was verified through formal acceptance tests before use.

During data reduction and compilation, data were validated to identify inconsistencies and anomalies. Data validation was performed by comparing the data to expected or predetermined

ranges and past results. Decisions to include or eliminate suspect or unverifiable data were determined during technical reviews by qualified personnel.

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6. GLOSSARY

(NOTE: Several terms in this Glossary emphasize their specific relationship to the Yucca Mountain Project.)

alluvial fan	A relatively flat to gently sloping mass of loose rock, shaped like an open fan, deposited by a stream or streams on a plain or broad valley.
alluvium	Unconsolidated rock debris deposited by flowing water during relatively recent geologic time; generally unsorted to semi-sorted.
ambient	Undisturbed, natural conditions, such as ambient temperature caused by climate; surrounding conditions. Also, the geographic area in which the public has free access and where the ambient air quality standards apply.
analog seismic station	A stationary device for collecting and storing real-time seismic data.
aquifer	Subsurface saturated rock of sufficient permeability to transmit groundwater and yield usable quantities of water to wells and springs; a rock formation, group of formations, or part of a formation with these characteristics.
arid	Areas where mean annual evaporation exceeds mean annual precipitation. Arid regions typically have high rainfall variability, with annual amounts ranging between 4 and 12 inches.
ashfall	The descent through the atmosphere of ash from a volcanic eruption; volcanic ash resulting from an ash fall and lying on the ground surface.
ash-flow tuff	A tuff deposited by a turbulent blend of unsorted volcanic debris and high-temperature gas ejected explosively from fissures or a crater.
basaltic lava flow	Fine-grained, dark-colored volcanic rocks erupted onto or near the land surface from a volcano or fissures.
borehole	A hole drilled into the earth's crust to collect hydrologic and geologic data.
borrow pit	An excavated area where earth materials such as sand and gravel are obtained.
bulkhead	A wall or embankment in a mine or tunnel that protects against earthslide, fire, water, or gas.

caldera	A large, basin-shaped volcanic depression formed by violent eruptions and collapse of the crust.
carbonate aquifer	An aquifer in limestone and/or dolomite. Carbonate aquifers typically produce hard water, that is, water containing relatively high concentrations of calcium and magnesium.
chain-of-custody control	A form that documents collection, transport, and analysis of samples (e.g., water, rock).
cinder cone	A conical hill formed by the accumulation of cinders and other ejected debris around a volcanic vent.
clearance survey	A survey conducted to find and remove desert tortoises prior to land-disturbing activities.
coliform bacteria	Bacteria that originate as organisms in soil or vegetation and in the intestinal tract of warm-blooded animals (fecal coli). This group of bacteria has long been an indicator of the contamination of water and possible presence of intestinal parasites and pathogens.
decommission	The process of removing from service a facility in which nuclear materials are handled. This usually involves decontaminating the facility so that it can be dismantled or dedicated to other purposes.
drift	A horizontal, excavated underground passage or tunnel.
effluent	A liquid or gaseous waste that is discharged to the environment.
Euroamerican	A person whose ancestry can be traced to Europe, but who immigrated to the United States and became either a naturalized or legal citizen.
evapotranspiration	The combined processes of evaporation and plant transpiration that remove water from the soil and return it to the air.
fault	A fracture or zone of fractures along which there has been displacement.
fault system	Two or more sets of faults that are mostly parallel and that developed during a particular deformational episode.
floodplain	The strip of relatively smooth land adjacent to a river or stream channel or dry wash, that is covered by water when the river or stream overflows its banks.
fugitive dust	Airborne particulate matter, emitted into the atmosphere from wind erosion of exposed soils or from vehicles traveling over unpaved roads

gap analysis	A review of existing environmental management procedures against those required by accepted standards to identify if any procedures are missing or inadequate.
geologic repository	A facility for the long-term isolation of spent nuclear fuel and high-level radioactive waste in excavated geologic media.
germination	The process whereby seeds or spores sprout and begin to grow.
greenhouse gases	Greenhouse gases are natural and man-made substances that trap outgoing infrared energy emitted by the earth, warming the atmosphere and the earth. Common examples include water vapor, carbon dioxide, methane, some hydrofluorocarbons and perfluorocarbons.
groundwater	Water contained in pores or fractures in either the unsaturated zone or saturated zone below the surface.
high-level radioactive waste	(1) The highly radioactive material that is produced from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing, and any solid material derived from such liquid waste that contains fission products in sufficient concentrations. (DOE would vitrify liquid high-level radioactive waste before shipping it to the repository.), and (2) other highly radioactive material that the U.S. Nuclear Regulatory Commission, consistent with existing law, determines by rule requires permanent isolation.
Holocene epoch	The most recent epoch of geologic time that extends from the end of the Pleistocene to the present, or approximately the past 10,000 years; also the rocks and deposits formed during this time.
human exposure	The condition of a human being subject to some effect or influence from a hazardous material, pollutant, or ionizing radiation generally considered as potentially resulting in an adverse physical response.
hydrology	The study of the occurrence, distribution, movement, and chemistry of water.
injection well	A deep well into which water, pressurized gas, or other material is pumped to test specific properties of the rock through which groundwater flows.
invasive species	An alien plant or animal species whose introduction does or is likely to cause economic or environmental harm or harm to human health.

leachfield	A component of a sanitary sewage system that uses soil for the disposal of effluent discharged from a septic tank. The leachfield consists of a series of perforated pipes buried in trenches that distribute the effluent below the surface.
Material Safety Data Sheets	A manufacturer's summary of the chemical characteristics of a material, including information about the material's toxicity, storage, handling, first aid procedures, cleanup of spills, and disposal.
mean peak annual dose	The maximum of the mean annual radioactive energy absorbed by living tissues over the 1-million-year postclosure period of the repository.
native species	Plant or animal species that occur naturally (without introduction by humans) in the region.
ozone-depleting substances	Ozone is the triatomic form of oxygen. In the stratosphere (6 - 12 miles to about 33 miles above the surface), natural ozone protects the Earth from the sun's ultraviolet radiation. Ozone-depleting substances are certain compounds that contribute to the depletion of this protective ozone layer.
Paleozoic	A geologic era extending from the end of the Precambrian to the beginning of the Mesozoic, dating from between 570 and 225 million years ago.
particulate matter	Small airborne solid particles such as dust, smoke, fumes, or smog, that occur naturally or from human activities.
perennial	A plant that lives or continues more than 2 years, whether it retains its leaves in winter or not.
pollution prevention	Preventing or reducing the generation of pollutants, contaminants, hazardous substances, or wastes at the source, or reducing the amount for treatment, storage, and disposal through recycling.
postclosure	The period of time after closure of the geologic repository.
preactivity surveys	A biological, archaeological, and/or radiological survey conducted before granting approval to use land by Project participants. These surveys are designed to identify, preserve, and protect biological and archaeological resources, and identify and protect personnel from radiation sources.
Precambrian	All geologic time, and its corresponding rocks, before the Paleozoic. It is equivalent to about 90 percent of geologic time and marked by the appearance of primitive forms of life.

preclosure	The period of time before and during closure of the Yucca Mountain repository.
quality assurance	All those planned and systematic actions necessary to provide adequate confidence that a program or item will perform satisfactorily.
radiation	The emitted particles or photons from the nuclei of radioactive atoms. Some elements are naturally radioactive; others are induced to become radioactive by irradiation in a reactor. Naturally occurring radiation is indistinguishable from induced radiation.
radionuclide	A radioactive atom with an unstable nucleus that spontaneously decays, emitting ionizing radiation in the process.
recharge	The movement of water from an unsaturated zone to a saturated zone.
reclamation	The conversion of disturbed land to a pre-disturbed condition.
recontour	Grading soil or loose rock debris on a disturbed site to match the natural slope and drainage of the surrounding landscape.
remediation	Action taken to permanently remedy a release or threatened release of a hazardous substance to the environment. Also synonymous with <i>reclamation</i> .
sample transfer	A form used on the Yucca Mountain Project for documenting the transfer of samples (e.g., water, rock) from one person to another.
saturated zone	The area below the water table where all spaces (fractures and rock pores) are completely filled with water.
sedimentary deposits	Unconsolidated rock debris that has accumulated in layers.
sedimentary rocks	Rock resulting from the consolidation of loose sediment that has accumulated in layers.
site characterization	All activities associated with the determination of the suitability of the Yucca Mountain site for a geologic repository. On February 14, 2002, the Yucca Mountain site was recommended by the Secretary of Energy to the President as a suitable site for a repository.
spent nuclear fuel	Fuel that has been withdrawn from a nuclear reactor following irradiation, the component elements of which have not been separated by reprocessing. For this Project, this refers to (1) intact, nondefective fuel assemblies, (2) failed fuel assemblies in canisters, (3) fuel assemblies in canisters, (4) consolidated fuel rods in canisters, (5) nonfuel assembly hardware inserted in pressurized-water reactor fuel

assemblies, (6) fuel channels attached to boiling-water reactor fuel assemblies, and (7) nonfuel assembly hardware and structural parts of assemblies resulting from consolidation in canisters.

Tertiary

The first of two geologic periods of the Cenozoic Era extending from the end of the Mesozoic Era to the beginning of the Quaternary Period, covering a time span approximately from 65 million to 2 million years ago.

tracer

A substance (liquid or gas) usually injected through a well to determine the direction and speed of groundwater flow, as well as the characteristics of the rock through which the tracer travels.

tuff

Rock formed from compacted fragments of ash and dust, which have been ejected explosively into the air and settle onto the land surface. If the particles are sufficiently hot and contain enough gas, they may weld together forming welded tuff. Tuff is the most widely exposed rock at Yucca Mountain.

verbatim compliance policy

Compliance with all procedures to the letter.

volcanic aquifer

A water-bearing unit of volcanic rock or volcanic sediment that yields water in a useable quantity to a well or spring.

waste forms

A generic term that refers to the different types of radioactive waste.

well-logging

All operations involving the lowering and raising of measuring devices or tools into wells for the purpose of obtaining information about the well or adjacent formations.